DECEMBER

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

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JAMES A. BLUE, D.D.S., Birmingham, Ala.
Vice President of the American Dental Association

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Original Communications

THE PHILOSOPHY OF PROFESSIONAL OBLIGATION*

By HUGH W. MacMILLAN, D.D.S., M.D., F.A.C.D., Cincinnati, Ohio

THE occasion of commencement must be commonplace to the members of the graduating class of the Dental School of Western Reserve University. Up to this point in their careers, some of these graduates have been forced to endure at least three commencement addresses at grammar school, high school, and academic college graduations. Now, at the end of their professional college days, they are forced to sit through a fourth address expecting to hear again those same old platitudes to the effect that commencement is the beginning, not the ending; that they must take up the torch and carry it forward, and that the welfare of generations yet unborn depends on their acceptance of the great privilege and responsibility of beginning all over again.

For twenty years, more or less, these graduates have been regimented into classes, have been compelled to undergo hundreds of oral and written examinations, have answered roll call thousands of times, have been the guinea-pigs on which to try out new teaching methods and practices in these transitional days of attempting to find an easier way to knowledge; have been forced, at times, to accept theories and prejudices for the good and sufficient reason that they happened to be printed in textbooks, and have been forced to sacrifice those never-to-be-repeated days of youth in the modern highly competitive scholastic weeding out or wearing down process, which too often does not result in the survival of the intellectually fittest.

In order to emphasize the fact that you graduates have been preached to more than enough already and to indicate my sincerity in sympathizing with you, I hasten first of all to congratulate you on having been able to surmount the various hurdles of these last few years and extend to you a hearty welcome into a new world which, with all its responsibilities, trials, and tribulations, will be

*Address given at the commencement exercises of the School of Dentistry, Western Reserve University, June 10, 1936.

heaven compared to what you have been through. Secondly, as a greater indication of my sincerity, if it were possible, I should like to excuse you from the rest of this address. Since it might interfere with the committee's arrangements, it probably would not do for you to leave the platform; but, at least, sit at ease—only do not scuff your feet too noticeably. The fact that you will not be forced to take a written quiz on this last lecture should compensate you, in part, for being forced to sit through it.

Commencement Day addresses are, as a rule, directed to the members of the graduating class. From now on, this address will be directed, instead, to the parents and friends of the graduates—chiefly to the parents, whose interest, devotion and acceptance of responsibility throughout these years of preparation have made it possible for the dental school of Western Reserve University to have a 1936 graduation.

A moment ago, I welcomed the graduates into a new world. I should like to discuss with you parents briefly some of the characteristics of that new world for which your sons have been trained. There are a great many things about that new world which fathers and mothers who are not professional people do not understand. Unfortunately, there are a great many graduates who find out about that new world only by heart-breaking experiences, through trial and error. My greatest desire today is that I might possess the ability to explain or interpret the metamorphosis or rebirth which every man or woman must pass through who becomes a respected citizen of that new world which these graduates have elected to enter.

This world, as you have already suspected, is the Professional World, and it is best described by contrasting it with the World of Business.

Justin Miller, dean of the School of Law, Duke University, in an article entitled "The Philosophy of Professional Licensure," emphasizes the differences between a profession and a business as follows:

> In business transactions each participant is assumed to be equally well informed and equally able to hold his own in the give and take of trade and barter. The well known maxim of the law warns: "Let the buyer beware." On the other hand, the member of a profession is assumed to be better informed than the client or patient whom he serves, and stands in the position of champion or protector.
>
> The nature of professional service requires the existence of a relationship of trust and confidence. In order that he may be best served, a person must break down the barriers of reserve which otherwise serve to protect him, and deliberately reveal to his professional adviser secrets of physical or mental disability or secrets of business of the most intimate nature. The situation which makes possible the most beneficent service from a highly skilled, trustworthy professional, therefore, is one which makes equally possible his spoliation, if the one in whom such confidence is placed happens to be a charlatan or a shyster.
>
> A professional man cannot treat such a relationship in a casual way, and the methods of licensure must be such as to insure the constant recruiting of men who are adequately trained to render skilled service and alert to accept the responsibility of protecting those whom they serve against spoliation.
>
> There are in each professional group some who are so unaware of the nature of a profession and so willing to exploit it that, like the French king, they might well say, "After us the deluge." Moreover, there are constantly knocking at the doors and asking for admission, shysters and scalawags whose only reason for seeking admission is that, as one applicant recently testified, they have heard "it's an easy way to make a lot of jack." Advancing a step or two beyond this type we come to a group

of professional men who are frankly resentful of any obligation to render service beyond that which is involved in giving the best which they can to their individual paying clients. This, too, is a highly unfortunate attitude. While such men are to be commended for their skill and for their devotion to their patients, they seem unaware of other professional obligations and forget that each member consciously or unconsciously interprets the meaning and purpose of the profession to every person who knows him in his professional capacity. The fact that the professional obligation goes much farther than devoted and skillful service to paying patients is freely conceded by the leaders of the various professions, and is usually stated in professional oaths and canons of ethics.

In the practical application of these principles to the professions of law, medicine and dentistry, it will be readily conceded that the client or patient is in no position to form an estimate as to the character or quality of the professional services or the indication of what services are needed. A layman is not qualified to argue with his attorney about some involved legal procedure nor debate with his physician a differential diagnosis between appendicitis and pyelitis. Similarly, the dental patient, since he has not spent from four to six years in studying dentistry, is neither able to diagnose and prescribe for diseases of the mouth nor decide on the merits of fixed and removable prosthetic replacements. Neither is he able to determine the extent of dental caries nor evaluate different filling materials. If he happens to be suffering from some systemic ailment which, according to the Sunday supplements, is miraculously cured by extraction of teeth, he surely will become a victim of spoliation if he gets into the hands of an unscrupulous dental racketeer, one whose cupidity has removed every trace of professional idealism or whose cleverness in the advertising columns of the daily paper enables him to "ensnare the class of people least able to be exploited." Dean Miller's inference that the true professional man stands in the position of champion or protector of his patient makes clear the fundamental difference between the professions and business.

The profession of dentistry is represented throughout the United States by 40,000 dentists who have joined themselves into a national society, the American Dental Association, which is organized on a plan more democratic than the United States Government. At its annual meetings, attended by thousands of dentists, chosen representatives of the various component state societies transact its business and control its policies. Government by public opinion, free and frank discussion, parliamentary methods of procedure, equality in representation, pitiless publicity and majority rulings characterize its proceedings. The American Dental Association has a charter and constitutional and administrative by-laws, as has every large organization; but, differing from business associations, it is governed by a far more rigid set of restrictions, which unconsciously influence the decisions of its administrative officers more than by-laws and economic difficulties. This superconstitution of the American Dental Association is its Code of Ethics.

This code had its origins in ancient Greek philosophy, in the early Hebraic religious writings and in the Golden Rule of the New Testament. It specifies the duties of dentists to each other and to the profession at large, and the duties of the profession to the public. The Code is the recognition by the profession of its moral responsibility and is an ideal to which every member of the profession should aspire. Suppose we look into some of its provisions, which must be followed if one becomes a member or continues as a

member of the American Dental Association. It is not secret. A printed copy of the Code can be obtained for examination from any ethical dentist. Throughout the Code, the professional man is constantly reminded of his duties and obligations to the public. He is not to forget that "a well merited reputation for honesty and professional ability carry with them their own rewards."

He may not announce his name in any kind of public directory under a heading such as "Specialists" or "Surgical Dentists," or under any other classification that might create in the mind of the reader the impression that the person so listed is superior to those whose names appear under the simple heading "Dentists." Think of the number of eminent, trustworthy and competent specialists whom you know by their reputation alone. You will not find their names in public advertising nor their specialty emblazoned on their office doors.

A dentist possessed of a high conception of moral responsibility to his profession and to the public "cannot receive remuneration from patents for surgical instruments or medicines, accept rebates on prescriptions or surgical appliances, or perquisites from attendants who aid in the care of patients."[1] He may invent an instrument or discover the cure for dental caries, yet he cannot receive remuneration from its sale or manufacture. If he wishes to resign from his professional society and go into the business of manufacturing his invention, he may do so, of course, but he then is no longer a professional man. At first thought, this may seem unjust, but it must be recalled that "as soon as profit motives dominate a calling it ceases to be a profession." It has been stated that a profession has standards and rules of conduct based on the theory that the service rendered is very much more important than the compensation received. "A profession has for its prime object the service it can render to humanity; reward or financial gain should be a subordinate consideration." A professional man cannot combine with his professional duties the operation of a manufacturing business conducted for profit and continue to give his best efforts to his patients. If he were to collect a royalty on an invention, his commission would increase the selling cost. Thus, he would be collecting a tax from each of his brother practitioners who purchased the product. If he patented for profit his cure for dental caries, he would be guilty of the gravest injustice to the public. It is the aim of the profession to exemplify the old saying:

> What I kept I lost,
> What I spent I had,
> What I gave I have.

In contradistinction to the world of business, the professional world, into which these graduates are about to enter, is self-governed and self-disciplined. The public has also delegated, for the most part, the teaching, the licensure, the enforcement of the dental law, and even the writing of the law, to the profession itself.

When these graduates first decided to study dentistry, they had to meet satis-

1. Opinion of the Judicial Council of the American Dental Association concerning the case of the Ethical Products Company, delivered before the House of Delegates, San Francisco, Cal., July 16, 1936. "To the Council on Dental Therapeutics, American Dental Association: In accordance with your request for the Judicial Council to render an opinion on the ethics of the Ethical Products Case, please be advised that the Judicial Council rules that this case constitutes a violation of Section 6 and 12. Therefore, for a group of dentists to undertake to sell stock to dentists in a medicine company for the purpose of promoting the sale of remedies to their patients is considered a violation of the Code of Ethics of the American Dental Association."

factory predental requirements and to possess certain other qualifications, which were set up, not by the public, but by various committees, boards and associations composed of dental educators and practitioners of the dental profession. At the present time, there is considerable discussion concerning the specific requirements for the two predental years, as to how much time shall be given to the study of English, chemistry, biology and physics. The general public rarely enters into these discussions. Distinguished teachers from academic colleges may be called in consultation, but the final decision is made by the dental profession itself.

The gradual advancement of dental education from an apprenticeship to a formal course of instruction of one year, of two years, of three years, of four years, of four years with one predental year and of four years with two predental years has been achieved, not by any lay organization, political party or public welfare group, but by the profession itself. The classification and accreditation of dental teaching institutions is wholly within the control of the profession. Nine representatives, all of whom are dentists, elected from three great dental organizations and together forming the Dental Educational Council of America, have set up and are enforcing, to the best of their ability, standards for an acceptable dental school. This council is responsible to a greater degree than any other organization or combination of organizations for the high educational and professional status which the American dental profession enjoys throughout the world. The opportunity and responsibility now presents itself to these graduates to enter into the discussion of dental educational problems and to suggest improvements in curriculum content, standards of teaching and educational objectives, even to the inspection and classification of dental colleges and infirmaries.

Boards of dental licensure, such as the state boards of dental examiners and the National Board of Dental Examiners, are primarily concerned with the protection of the public; yet the public has no representation on the boards. The public disclaims all responsibility regarding the personnel of these boards, except that the governor of each state generally makes the appointments to the dental board of his state, and even then he must appoint members of the dental profession. In at least one state, the governor must appoint dentists who have been chosen by the state dental society. The general public is, for the most part, unaware that boards of dental examiners exist and hears of them only when some charge is brought against an alleged illegal practitioner or other violator of the dental statutes. The confidence which the public places in the dental profession to maintain, through its representatives on the various boards of dental licensure, adequate standards of public service and public health, is one of the best illustrations of the difference between a profession and various businesses which require licenses in order to operate. As long as the profession merits that confidence and regulates the conduct of its affairs in such a manner that the public health and needs are of first consideration, under our democratic form of government the present happy arrangement will continue. If that confidence of the public should be lost, dentistry would no longer continue to be "self-governed and self-disciplined." It would cease to be honored as a profession. Licenses to engage in the business of dentistry would then be issued by a board of laymen in much the same manner as licenses are issued to saloon keepers, cigaret vendors, hucksters and county fair concessionaires.

After your son has passed his examination for licensure, he will select a location and begin to practice his profession. He will find that he must practice in conformance to the dental laws of his state. Here again, he comes in direct contact with the matter of the prestige of the profession. Dental laws are written by members of the dental profession. Designed primarily for protection of the public, it would seem that they should be written by the public for its own benefit; but again the public places its confidence in the profession. Opinions from attorneys as to legal phraseology and constitutionality may be sought, but the dental profession itself is wholly responsible for the letter and spirit of the dental statutes. Suppose, for example, one of these young practitioners should advertise in the daily papers his alleged professional superiority. Immediately he would come in conflict with certain provisions of the dental law which prohibit unethical advertising. At first thought, he might charge discrimination, that his neighboring practitioners were protecting themselves for selfish reasons and that they were creating a monopoly. On further investigation, he would find that the law is, in the last analysis, a practical adaptation of the dental code of ethics expressed in legal phraseology and that its enactment and enforcement is for the protection of the public—not the profession.

A recent opinion delivered by Chief Justice Hughes of the Supreme Court of the United States explains in no uncertain manner the harmful effects of unethical advertising to the general public. Apparently, Mr. Justice Hughes' whole argument is based upon his conception of the ethical responsibilities of a profession. His decision is the greatest compliment ever paid to the dental profession. It is the custom of some medical schools to require their graduates to sign the Oath of Hippocrates on graduation. If I were dean of a dental school, I should require each graduate, before receiving his diploma, "to read, mark, learn and inwardly digest" the Hughes decision and sign it in the presence of the whole faculty as witnesses.

A quotation from this famous opinion follows:

> "Inducing patronage," said the court, "by representations of 'painless dentistry,' 'professional superiority,' 'free examinations,' and 'guaranteed dental work' was, as a general rule, 'the practice of the charlatan and the quack to entice the public.' "
>
> We do not doubt the authority of the State to estimate the baleful effects of such methods and to put a stop to them. The legislature was not dealing with traders in commodities, but with the vital interest of public health, and with a profession treating bodily ills and demanding different standards of conduct from those which are traditional in the competition of the market place. The community is concerned with the maintenance of professional standards which will insure not only competency in individual practitioners, but protection against those who would prey upon a public peculiarly susceptible to imposition through alluring promises of physical relief. And the community is concerned in providing safeguards not only against deception, but against practices which would tend to demoralize the profession by forcing its members into an unseemly rivalry which would enlarge the opportunities of the least scrupulous. What is generally called the "ethics" of the profession is but the consensus of expert opinion as to the necessity of such standards.

The history of professional ethics began twenty-five hundred years ago. The history of the evolutionary development of man, a vertebrate, extends back for five hundred million years. This disproportion between the short length of time taken up with man's intellectual supremacy and moral development as compared

with the countless ages concerned in his physical development may be the explanation, in large part, of the difficulty which even the most ethically minded person has in drawing the line between moral obligation and self-interest.

In order to contrast the time element involved, we shall borrow a lesson from the scientific studies of these graduates. Modern anatomy traces for a billion years the development of living beings from their earliest and most primitive forms to the so-called "godlike" figure known as man. The Cenozoic era, in which we are living at the present time, has extended back for 50 million years, the Mesozoic era for 150 million years, the Paleozoic era for 300 million years and the Archeozoic era for a still greater length of time, 600 million years. In order to make practical use of these figures, it will be necessary to construct a chart to portray graphically the different lengths of time concerned with the different phases of vertebrate development.

Suppose we construct a chart taking the unit of one mile as representing 1 million years. The distance between Cleveland and Ashtabula, Ohio, 50 miles, would represent 50 million years, the Cenozoic era or the age of mammals. One hundred and fifty miles further east lies Buffalo, N. Y., the distance representing 150 million years, the Mesozoic era. Three hundred miles further in an easterly direction lies New York City, the starting point on our chart of the Paleozoic era, and the beginning of the long line of ascent of the vertebrates, culminating in man.

We are concerned chiefly with that part of the chart represented by the distance between Cleveland and Ashtabula. Probably the earliest records of man are chipped flints taken from deep geologic strata of the Pliocene period in England, estimated to be 5 million years old. On our chart, this would extend along Euclid Avenue for 5 miles—not very far on our way to New York City. One of the oldest supposedly human remains which have been discovered is the completely petrified Chinese skull found embedded in a geologic layer estimated to be 1 million years old. From this auditorium as the starting point, 1 million years would advance us on our chart 1 mile along Euclid Avenue. Civilization and the dawn of recorded history began, as we all know, now that we are on more familiar territory, around 5,000 years ago, which would be represented on our chart as 25 feet, or half the width of a city lot. To repeat: On our chart extending from Cleveland to Ashtabula, Buffalo and New York City, the period of man's vaunted civilization extends in an easterly direction from the front of this platform only 25 feet. The Oath of Hippocrates was written approximately twenty-five hundred years ago, or one half of the length of time of recorded history, a distance on our chart of approximately 10 feet from this platform. The proportion of 10 feet to 500 miles is not yet an accurate ratio since the Oath of Hippocrates and the Hebraic teachings were written before Christ. The modern Code of Ethics is founded for the most part on the Golden Rule given to the world less than two thousand years ago.

Is there any wonder that it is so difficult to live and practice according to the Code of Ethics? For hundreds of millions of years during the development of the vertebrates leading to man, there has been one supreme law, the law of the survival of the fittest. There has been one dominant urge, the urge for the perpetuation of life. When asked our ages, we glibly answer the number of years since our birth, but in reality our ages extend back through living protoplasm for hundreds of millions of years. As we

bear the stamp of heredity and environment on the form and function of our physical bodies, by the same token we inherit the necessity for their nourishment and the urge for their preservation. Those brute inheritances: hunger, fear, envy, pretense, deception, trickiness, revenge, are as deeply ingrained in our subconsciousness as are the sensations of hearing, seeing, smelling, tasting and feeling. Professional ethics, the consciousness of the profession of its moral responsibility, is the dividing line between the lower animal and man divine. It is a goal toward which professional men aspire, but to which few attain. It is a spiritual inheritance characterized by good will, justice, temperance, meekness, charity, moral courage and intellectual honesty.

And now may I repeat that I have made the attempt to interpret to you parents the professional world which your son has elected to enter. I have tried to impress on you the fact that he must live and practice according to a different code and observe a different etiquet. I should like to make one request. It is that you always remember that the standard by which his success is to be judged is not the standard of the market place. His success is to be measured in character, not in wealth; in service to humanity and to his profession, not in personal aggrandizement. This commencement should be of as great significance to you as to him. You also should begin over again and be reborn into an appreciation of his profession. And your reward? By journeying along with him in his professional life, you will catch the spirit of his new world, and by applying those same principles and practices to your lives, you will help him to advance still farther that highest conception of man's intellectual development: the professional man's obligation to his profession and to his fellow man.

FUNDAMENTALS OF NITROUS OXIDE-OXYGEN ANESTHESIA*

By GEORGE W. CHRISTIANSEN, A.B., D.D.S., M.S., Detroit, Mich.

WHETHER local or general anesthesia should be used, the operator alone can decide. Without training and without experience in overcoming such handicaps as are offered by the mouth prop, gauze pack, restricted vision, interference by the patient and uncertainty as to his condition, work under general anesthesia is difficult and results are discouraging and unsatisfactory. There are certain routine procedures by means of which these obstacles can be overcome, so that, when properly administered, nitrous oxide-oxygen anesthesia provides a condition for oral operations that is often ideal, and the requirements will be stressed, even to the point of repetition. The anesthetist must know when the patient is in the proper depth of anesthesia and keep him there. The mouth pack must be in cor-

*Read before the Section on Oral Surgery, Exodontia and Anesthesia at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 15, 1936.

rect position and the mouth open wide enough and held so by a mouth gag that stays where placed. It is essential to control bleeding, either with an aspirator or sponges, use of which prevents the mouth pack from becoming saturated and its efficiency reduced or destroyed. This pack must be changed frequently and reinforced with more gauze as the intraoral conditions demand. Satisfactory anesthesia is not due to luck, but is the result of experienced teamwork and the use of aids to nasal breathing.

After nitrous oxide-oxygen anesthesia has been chosen, premedication is the consideration. The decision here depends on several conditions: the type of patient as to age, physique, size, temperament and habits; the length and kind of operation to be performed, and the difficulties that may be encountered. The need of preliminary narcosis and the type should be determined at the time of examination, so that ample time will be available to permit relaxation and even drowsiness to ensue. If sufficient time is not given this phenomenon, we not only lose the benefits during induction, but also may later find the patient in deeper anesthesia than is desirable.

Fig. 1.—Normal relationship of tongue to oral pharynx, showing an unobstructed airway. This should be maintained throughout anesthesia.

Fig. 2.—Result of depression of mandible (*M*). The tongue almost makes contact with the pharyngeal wall, reducing the airway (*A*) and making breathing difficult. Improper placing of the mouth prop will cause this condition.

While it is true that many brief cases are managed with complete satisfaction without this preparation, we should bear in mind the synergistic effect from the use of sedatives with general anesthetics. The patient is subdued and less of the anesthetic is necessary, induction is shorter and maintenance is usually calm and peaceful.

Preoperative sedation transforms what would have been a nervous, struggling, apprehensive neurotic into a tranquil cooperative patient and permits the operator to do his work carefully and without annoyance nor interruption.

The two most common forms of drug administration for this purpose are hypodermic and oral, the drug being in capsul form in the latter. With the former method, morphine and scopolamine in combination are frequently used because the former acts on the central nervous system as a sedative and anodyne and the latter as a hypnotic. Further, as both drugs tend to decrease glandular secretion, in cases of excess salivation, one very annoying hazard is decreased. No anesthesia progresses smoothly if the upper respiratory tract is partially filled with fluid.

There is much objection to morphine because it may mask signs of anesthesia and does cause postoperative nausea.

Also for hypodermic use, another preparation is composed of pantopon, a derivative of opium containing all the alkaloids, and scopolamine. Of the former, Collins[1] says:

> Speaking of the central action only, one can ascribe to the total alkaloids the following advantages over morphine:
>
> (1) They depress the respiratory center less in relation to their narcotic activity.
>
> (2) They produce vomiting less readily and less frequently.
>
> (3) The patient wakes more readily from pantopon than from morphine.

Fig. 3.—Proper placing of mouth pack, which prevents mouth breathing and helps maintain normal relationship of structures. The airway is not obstructed.

> (4) One becomes habituated to opium, but less easily, however, than to morphine.

For oral use, the most satisfactory premedicant for nitrous oxide-oxygen anesthesia is one of the barbitals, pentobarbital sodium (nembutal). This is prepared in capsul form and the dosage is from 1½ to 3 grains. The action is hypnotic, sedative and antispasmodic. The effect is rapid and profound and is of short duration, and there is not the postoperative nausea and vomiting that follow the use of morphine.

1. Collins, Frank: Preanesthetic Medication: The Barbiturates, Cur., Res. Anes. & Anal., 12:134 (May-June) 1933.

POSITION OF PATIENT

The next step is to tilt the chair slightly backward and seat the patient so that the back rest furnishes adequate support. The slouching position wherein only the shoulder blades and the end of the spine support the body makes breathing difficult and the patient more easily slides to the floor. The headrest is adjusted so that the chin is not forward on the chest nor tilted high, but with the airway straight. (Fig. 1.) The feet are crossed at the ankles and the hands clasped in the lap.

Fig. 4.—Improper placing of mouth pack pushing tongue back and occluding airway (*A*). Breathing is made very difficult, and asphyxia, struggle and poor anesthesia result.

A suitable mouth prop is now chosen, and selection is not a matter of a glance followed by snap judgment, for on it depends the satisfactory completion of the work planned. Many extractions are greatly complicated by an attempt to work with the mouth but partly open, other teeth and the soft tissues being unnecessarily injured. Accidents occur when pressure gags are used to open the mouth wider, and gauze sponges and tooth particles may be lost.

Under nitrous oxide-oxygen anesthesia, there is contraction of the muscles of mastication, so that a nonrigid type of prop collapses, with partial reduction of the amount of separation planned, and the operator begins with a handicap. Therefore, when beginning, it is wise to determine carefully the position of the prop, placing it as far posteriorly as possible. If teeth are missing in the upper or lower posterior region, it is well to use a prop of such length that it will extend from the edentulous area to the opposing teeth. Here, it is out of the way and is partially locked in position. If it is carelessly placed in the anterior part of the mouth, the mandible may swing

Fig. 5.—Mouth pack extending into airway because placed too far posteriorly, causing obstruction (*A*). In a light plane of anesthesia, gagging would result.

laterally, vision of the field or posteriorly decreasing and the retrusion carrying the gauze pack and tongue backward to block the air passage. Frequently, asphyxia and faulty anesthesia are due to the improper position of the mandible, caused by ill-directed pressure from a mouth gag. (Fig. 2.)

If work is to be done on both sides of the mouth, when one side is finished the bleeding area should be covered with gauze and the mouth prop placed directly against this. Such a precaution prevents blood from entering the air passage to cause irritation and gagging. Additional gauze should be placed on the opposite side if there is any appreciable leakage around the throat pack. This increases the opportunity for satisfactory anesthesia, because the mixture of gases can be administered more as desired if not diluted by mouth breathing.

Just as the nosepiece is being adjusted, the flow of gases is started and the patient is instructed to inhale and exhale through the nose, thereby establishing this type

Fig. 6.—Small mouth pack passing over tongue and not necessarily entering trachea, but which may cause asphyxia by depressing epiglottis and closing entrance to trachea (*T*). Recovery of the gauze with curved nasal forceps is simple.

of breathing. Frequent assurance that all is well and that there is no need to hurry, and an atmosphere of quiet, calmness and efficiency, does much at this time to promote confidence and relaxation.

After a few breaths, the mouth is covered and the pressure is increased. The exhaling valve should be free at first so

that no sense of suffocation develops, and then, as exhalations develop in rate and volume, slight back pressure is produced by a part turn of the adjustment screw. This starts rebreathing, which conserves a part of each exhalation.

RESTRAINING THE PATIENT

Restraining devices are now applied, the patient being unaware that they are used; which is important because the sight or mention of such apparatus will suggest struggle and combat and may prevent a smooth induction. A means of restraint is necessary for all men and advisable for certain women. The mishaps from lack of this precaution are not the patient's fault. He is promised a vehicle of escape from pain, but this should not endanger his life from a plunge through a window nor threaten bodily or facial injury by a fall to the floor. Occasionally, the struggle results from lack of premedication, but more often the cause is an inexpert technic. Annoyances that accompany too light anesthesia, such as yelling, kicking, swinging of the arms, spitting and even biting, are exasperating and often seem intentional, but to lose one's temper and mistreat even a vicious subject is to admit defeat and amateurism. Nitrous oxide-oxygen anesthesia should not be attempted unless one is prepared for the stormy stage in the athlete or the alcoholic and for the struggle that follows the error of allowing the level of anesthesia to be unduly raised.

Proper restraint holds the clasped hands against the pelvis and prevents the body from sliding forward. Pressure must not be applied on the chest or the abdomen in any manner whereby inspiration is made difficult, yet movement of the body must be considered if there is resistance. Thus, movement of an incorrectly placed strap upward on the torso after arm movement must be prevented.

Holding the knees in close approximation, which helps to prevent sliding and kicking, is accomplished by placing a strap just above the kneejoints. Since any patient may suddenly begin to struggle, and with the time of application of restraint limited, the equipment needed to meet these contingencies must be readily available, simple to apply, effective and not injurious even in the event of great tension, and must not interfere with breathing.

Fiber trunk straps of different lengths seem best suited for this purpose. The material is strong and yet not injurious to the soft tissue that it touches, and, because of its softness, better adaptation is possible.

A simple method of preventing the body from sliding forward consists of passing a short strap over the wrists, pulling them tightly against the lower abdomen and fastening the strap behind and below. The patient can easily free his hands from this if he unclasps them; which is not possible if a longer strap is used and a round turn or two is made over each forearm. The buckle passes under the left arm of the chair, and the other end, under the right. These are joined in the midline. Vigorous arm movements are now of no avail as only a limited forward and backward movement is permitted. The transverse section remains in position at the correct tension, which discourages forward body movement.

No universal appliance, unless it be accurately adjustable, will meet these requirements, and since their use requires much time and assistance, elaborate operating table appliances are not practicable for use in the dental office. With a little practice, this and the knee strap can be applied in a few seconds.

DETERMINATION OF ANESTHESIA

After several breaths and an increase in the respiratory rate, a small percentage of oxygen is added and the mouth is covered, whereupon consciousness is rapidly lost. The stage or degree of anesthesia is determined by respiration, color and certain other signs which are classified and described by Flagg[2] as follows:

Muscular
  Lid
  Masseteric
Eye
  Conjunctivo-Palpebral
Pupillary
  Dilatation and contraction
Orbital Signs
  Movement and fixation of eyeball

Relaxation of the Upper Eyelid.—During normal sleep the eyelids, owing to the tone of the orbicularis palpebrarum, remain closed. In the late part of excitement and through the period of rigidity, one will find that if the eyelid is lifted and then released, it will fall back into place with more or less snap. Later it will remain open.

The lid sign is present when the eyelids on being separated remain separated. This sign should be taken on each side and the most inactive lid taken as the standard. In the later periods of induction, when stertor has come on and one is anxious to determine the exact condition of the patient, this sign will be found very valuable.

The masseteric sign is of little value, because there is seldom sufficient relaxation in nitrous oxid oxygen anesthesia.

The eye signs consist of three groups, the lid signs, the globe signs, and the pupillary signs.

The lid reflexes consist of reflex responses to irritation of the sensitive conjunctiva and cornea. These signs are as follows: The conjunctivo-palpebral reflex and the corneal reflex.

2. Flagg, P. J.: Art of Anesthesia, Ed. 5, Philadelphia: J. B. Lippincott Co., 1934.

The conjunctival-palpebral reflex is the reflex which causes the eyelid to close when the tip of the finger, in separating the lids, gently brushes over the margin of the upper lid. This reflex must be differentiated from the lid reflex, which has been described under the muscular signs, and is due to the tone or the elasticity of the muscle which moves the lids.

The Corneal Reflex.—This reflex is without doubt the most valuable eye sign which we have. It is elicited as follows: Standing behind and above the patient, the operator gently bathes the orbital conjunctiva by moving the upper lid over it several times. He then separates the lids with his index finger. When the lids have been slightly separated, the index finger is removed and the pulp of the middle finger, moistened with vaseline, is very gently caused to brush over the centre of the cornea. The degree of activity with which the eyelid then closes constitutes one of the most unvarying signs of the depth of anesthesia. The operation is concluded by again washing over the orbit by the upper lid. When N_2O and O are used without ether, one will usually find a snappy reflex during an entirely tranquil stage of maintenance.

The Orbital Signs.—The presence or absence of movements of the eyeball during anesthesia will often be of value. When consciousness is lost, however, and the period of excitement or rigidity is well developed, we find that the eyeballs are fixed or that there is a slow movement from side to side. Movements of the eyeball from side to side are almost always a sign of light anesthesia. During the stage of maintenance, when N_2O and O is the anesthetic, the eyes will often be found looking fixedly downward. When ether is used, they are usually fixed centrally.

Generally speaking, we may say that when the eyes are stationary, looking either downward or straight forward, loss of consciousness is certain, and usually induction is nearing conclusion or maintenance has been entered upon.

The Pupillary Signs.—Let us first con-

sider briefly the physiology of the pupillary changes which may appear. We must consider three reactions: dilation of the pupil; contraction of the pupil and the reaction to light.

The mechanism with which we have to deal is:

Two sets of muscles: the dilator muscles and the sphincter pupillae.

Two nervous systems: the sympathetic, which supplies the long ciliary nerves to the dilators, and the central, which supplies the short ciliary nerves to the sphincter muscles.

Two general conditions, which affect this mechanism: stimulation and paralysis.

Stimulation.—The pupil dilates when the sympathetic system is stimulated. The pupil contracts when the central system is stimulated by light (afferent impulses travel by retinae and optic nerves; efferent by third cranial and short ciliary).

Paralysis.—When the sympathetic system is paralyzed, the pupil contracts by virtue of the tone of the sphincters, aided by the engorgement of the ciliary blood vessels. When the central system is paralyzed, the pupil dilates by virtue of the elasticity of the elastic fibres of the pupil and by the emptying of the ciliary blood vessels which permit the lens to bulge forward.

Anesthesia in turn is divided into three stages:

(1) Induction
  (*a*) Excitement
    Dilation of the pupils
    Struggle
    Rapid inhalations
  (*b*) Rigidity
(2) Maintenance
  Loss of reflexes
  Relaxation (partial)
(3) Recovery
  Return of reflexes
  Consciousness

Respiration and color are also valuable aids to determining the depth of anesthesia. During induction, respiration is rapid, with deep inhalations and exhalations, which gradually become more normal and regular. If, in maintenance, the level is carried too low, they become shallow and almost entirely thoracic.

Color changes are very rapid and significant in nitrous oxide-oxygen anesthesia and are more apparent in the fair types. Two conditions are most noteworthy, cyanosis, which gives a dull blue or blackened appearance and is the result of oxygen desaturation, and anoxemia, which is less evident and may reveal itself only as pallor. Either condition will lead to respiratory paralysis if the oxygen intake is not increased and both respond immediately when enough oxygen enters the circulation.

McKesson's discussion of cyanosis and anoxemia is excellent:

So much has been written about cyanosis that the difference between nitrous oxid oxygen and other anesthetics has been lost sight of; and while deep cyanosis for long periods is not associated with satisfactory muscular signs, moderate cyanosis may be accompanied by muscular signs which are in every way indicative of good anesthesia and safety for the patient.

The color of the skin and mucous membranes of the Caucasian is not a safe guide in nitrous oxid-oxygen anesthesia. An anemic patient becomes pink in profound anesthesia and fails to show cyanosis even in the fourth stage, while a full-blooded plethoric patient may show slight cyanosis even before induction, which becomes more marked in normal anesthesia as judged by muscular signs. In the latter case, it is usually impossible to produce anesthesia while maintaining a pink skin and scarlet blood.

The color of the blood is determined by the relation between the oxygen absorbed and the total quantity of hemoglobin in the body.

Aside from the fact that a deeply cyanotic patient is usually not properly anesthetized as shown by muscular signs present at the same time, color in nitrous oxid-oxygen anesthesia is not a reliable guide since it bears no relation to the depth of anesthesia in different individuals.

After the desired depth of narcosis has been produced, as determined by muscular signs, any subsequent change in color roughly indicates increases or decreases in the oxygen administered and absorbed. Such a use of color is not sufficiently accurate to regulate the depth of narcosis except in light anesthesia.

Unless one believes and applies these principles, satisfactory anesthesia is impossible for at least two reasons. First, if cyanosis is interpreted always as a danger signal, light, unsatisfactory anesthesia results. The well-muscled and the drinker are always more or less cyanotic. Secondly, if one observes that the color is good and does not recognize unfavorable findings, respiratory failure will be frequent. Judgment must be based upon correct knowledge so that alarm is not felt if a degree of cyanosis persists. Unfortunately, years of experience in doing the wrong thing does not eventually bring success. The anesthetist who interrupts normal anesthesia when early cyanosis appears is likewise surprised when the deeply narcotized patient stops breathing without being blue or purple. At least two determinants of the stage of anesthesia coexist at all times.

As the respiratory rate increases and the rhythm becomes more regular, rebreathing is begun to conserve carbon dioxide and nitrous oxide and to make possible the administration of an evenly balanced mixture. Some control of pressure by the use of an adjustable exhaling valve and a dilating bag or bellows is desirable. During induction, if the gaseous mixture is not delivered with pressure, a feeling of suffocation may be experienced, and the patient will inhale too rapidly and deeply, or he may struggle.

During induction, the lid and eye signs are absent, the eyeballs move from side to side and the pupil is dilated from stimulation. As the stage of maintenance is approached and entered, the lid sign and lid reflex become sluggish and disappear, the pupil contracts and movement of the eyeballs ceases and they become fixed with the gaze directed laterally or downward. If the level of anesthesia is lowered still more, the pupils begin to dilate from approaching paralysis of the central nervous system, the corneal reflex is absent and respiration becomes more shallow. Recognition of these warnings, as well as knowledge of the fact that oxygen is the antidote for oversaturation with nitrous oxide, is essential, and the equipment must include a direct oxygen supply which can be administered instantly. The airway must be clear and is made so by the removal of any interference with the free passage of oxygen to the lungs. Much valuable time is lost if the mandible has dropped, carrying the tongue backward, or if a long mouth prop is holding the jaws wide apart, or if the throat pack is in the nasopharynx. The airway is cleared first and oxygen furnished with adequate pressure before other means of resuscitation are employed.

THE MOUTH PACK

When the stage of maintenance has been induced, the mouth cover is removed and a suitable gauze pack is inserted. Mouth packs of different sizes must be available because of the varying conditions met. The presence or absence of teeth, a short or long mandible and a large active or small tongue all must be considered. A pack too small for use in one mouth would be far too large for another. The gauze may contain cotton, or the necessary bulk is made up by using more gauze; but enough material must be present to act as an effective barricade for the nasopharynx against the inspiration of fluids or solids from the mouth

and also to insure nasal breathing only, by preventing leaks through the mouth. To maintain efficiency, the pack requires frequent renewal, and it should be supplemented with more gauze as the case progresses.

The position of the pack is important (Fig. 3) because, if improperly placed, it acts not as an aid but as an irritant (Figs. 4-5), and, if small, it may pass over the tongue to depress the epiglottis and close the larynx. (Fig. 6.)

One end of the gauze pack is inserted on the side opposite the mouth gag, insertion being facilitated by pulling the cheek on that side laterally with the finger placed in the corner of the mouth. The body of the pack is pushed posteriorly over the tongue to make contact with the soft palate and the other end is placed back of the mouth prop. This cannot be done if the tongue and palatal reflexes are present and hence must not be attempted until the necessary stage of anesthesia has been reached. For the same reason, if the level of anesthesia is raised enough later, the tongue will force the pack out of the mouth and make operating difficult and hazardous. Control of free bleeding with an aspirator is absolutely necessary if the throat pack is to function as it should.

When the patient is recovering, the mouth prop should be taken from the mouth to permit partial closure and easier breathing, and, as the reflexes return, the gauze pack is removed to prevent irritation and gagging.

The endotracheal method is designed to carry the anesthetic gases by rubber catheter through the nasal or oral passage directly into the trachea and thus is applicable in cases of restricted or impaired airways. The tube is introduced either directly, with the laryngoscope, which lifts the epiglottis and reveals to direct vision the laryngeal contents, or indirectly. By the latter method, the other nostril and the mouth are closed and the successful entrance into the trachea is evidenced by the typical laryngeal breath sounds transmitted through the tube. After this is done, the throat may be protected with gauze in the usual manner.

Analyses of our troublesome cases, wherein we obtain but partially satisfactory results, will usually reveal the cause of failure in technic and methods. The struggle during induction and the unsatisfactory maintenance stage, where the level of anesthesia is alternately dangerously deep with spasms and convulsions or so light that the operator is unable to work, the half-opened mouth and improperly curtained nasopharynx and postoperative vomiting of blood and mucus are not the usual concomitants of general anesthesia and should not be expected. Instead, they are the exception and their cause should be found and corrected.

Success in nitrous oxide-oxygen anesthesia depends on the proper positioning of the patient before induction begins, with provision of any restraint required to maintain this, recognition of the signs of anesthesia, proper administration of gases at sufficient pressure to exclude air and maintenance of a free airway at all times.

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OSSEOUS CHANGES IN THE ALVEOLAR PROCESS AND THEIR EFFECT ON PARTIAL DENTURES*

By FRANK H. McKEVITT, D.D.S., San Francisco, Calif.

OSSEOUS changes in the alveolar process affect the stability of artificial partial dentures just as they affect the stability of artificial full dentures, the difference, if any, being one of degree. It is incumbent on partial denture prosthetists to recognize these changes and the types of bone in which they occur before artificial replacements are made.

For purposes of description, the bone types that undergo changes are divided into three general groups: normal bone, bone calcified below normal and bone calcified above normal. It is when calcification has reached its highest degree, and decalcification has reached its lowest, that attention is directed forcibly to these phenomena because of a disastrous clinical experience.

The present knowledge of osseous deviations from the normal has developed slowly. One of the first uses of roentgenograms by the medical profession was to determine the nature of anomalies in density of the bones of the skeleton, with the possible exception of the teeth and jaws, the intensive study of these bones having been relegated to the dental profession. Little attention has been given the bone comprising the alveolar process, as it is a custom of dentists, with the exception of the experimental laboratory worker and the oral surgeon, to confine attention to the teeth and the peridental membrane.

The bones of the jaws have the same properties and composition as other bones in the skeleton. They are subject to a greater number of osseous changes because of varied requirements from birth to senility, and because of their easy accessibility as regards operative procedures when the teeth become pathologically involved. Bone changes from the normal, occurring in the skeleton, can be found in one form or another within that part of the skeletal structure encompassed by the teeth and the jaws.

The form of the trabeculae and the color tone of the bone image in films are roentgenologic indices as to density. The coarser trabeculation and the dark tones indicate slight calcification of bone, while finer trabeculation and lighter tones indicate greater bone density. It has been a custom of dentists in the past to return such films to the roentgenographer with the request that the color tones be made uniform.

One outstanding requirement of a roentgenologic study as presented here is that the equipment have adjustments for the maintenance of the same voltage and milliamperage, to permit the rechecking of cases irrespective of line conditions. Target distance and recording scales should be definite in order that rechecks of cases can be taken at exactly the same

*Read before the Section on Partial Denture Prosthesis at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 14, 1936.

angle, position, timing, voltage and milliamperage.

Dark-room technic likewise should be standardized in order that previous procedure may be duplicated when desired.

When roentgenograms of pathologic dental cases are compared with those of normal cases, structural changes may be observed in the bone and its trabeculae that are so much alike that characteristic pictures of hypocalcified and hypercalcified bone may be readily recognized as evidence of a disturbed calcium metabolism. The diagnostic value of such pictures is enhanced when they are accompanied by dental casts.

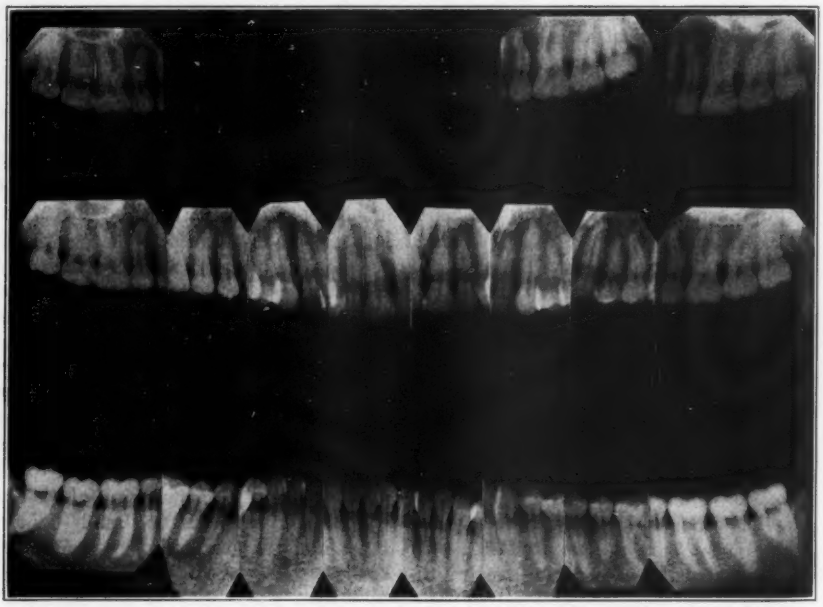

Fig. 1.—Normal bone, for comparison with hypercalcified and hypocalcified bone.

Osseous changes with which we are concerned fall into the general classification of atrophy and hypertrophy, with a predominance of atrophic changes. They are aspects of bone disease and, at times, the cause of much confusion to the prosthetist. Their early recognition will forestall costly failures of partial prostheses and will not only give a better understanding of the rebasing problem involving full and partial dentures, but will also permit of nice discrimination in the choice of tissue-borne or tooth-borne partial dentures.

The problem of bone destruction and repair lies within the field of mineral metabolism. Calcium fixation is a problem in biochemistry, on the eve of solution, but as yet unsolved.

The accompanying illustrations depict osseous changes that have been observed clinically and roentgenologically, and point to the fallacy of designing costly prostheses without acquaintance with the

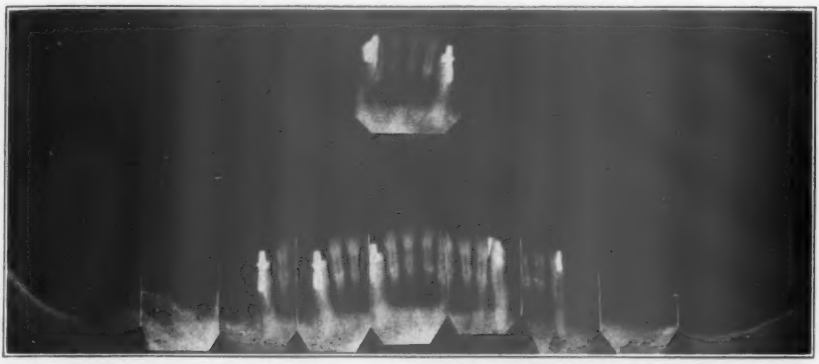

Fig. 2.—Case in which replacement with occluded maxillary full denture and mandibular partial denture with lingual bar and clasps lodged on hypocalcified bone has caused loss of bicuspids and produced absorption in bone already undergoing atrophic change.

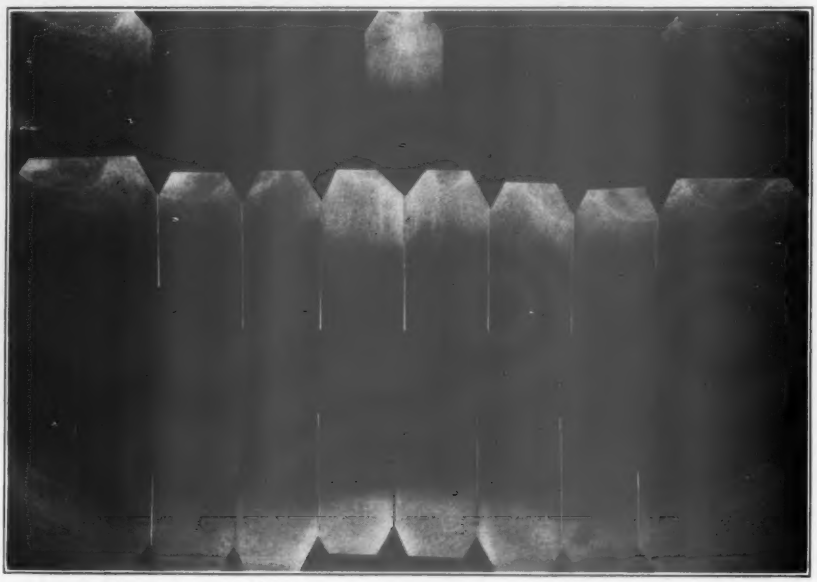

Fig. 3.—Hypercalcified bone in edentulous state (for comparison with normal and hypocalcified bone).

osseous structures upon which the dentures are to be lodged. They suggest a new aspect of bone change that is rapidly growing in importance. Their use as an integral part of a diagnostic scheme offers interesting possibilities, and it is hoped that they will serve as a rational means of clinical approach to endocrino-

pathic and other malacic diseases of bone. This does not mean that all cases shall come within range of this new order, but it does mean that, in selected cases, the manner of handling will differ from the prevailing method. Not the least of the factors in its success will be the interest and cooperation of the patient. It is the further intent of this essay to mark the necessary subordination of the dental operator to the internist, and particularly the relinquishment of medical control, for obvious reasons.

On the deduction that roentgenograms of alveolar bone indicate a disturbed calcium balance of endocrine or nonendocrine origin that nullifies the best of prosthetic efforts, these cases were referred to internists for further diagnostic study. The theory was supported by their findings. The accompanying illustrations will bring some fragmentary evidence that, it is hoped, may prove of special significance, the true implications remaining for us or our successors to realize.

Figure 1 is a roentgenologic study of a normal bone for comparison with hypocalcified and hypercalcified bone. Key's comment[1] on normal bone is significant: "In order that bone may be normal, we must have a normal bone anlage in the embryo, and there must have been a normal state of nutrition and function during the growing period and adult life."

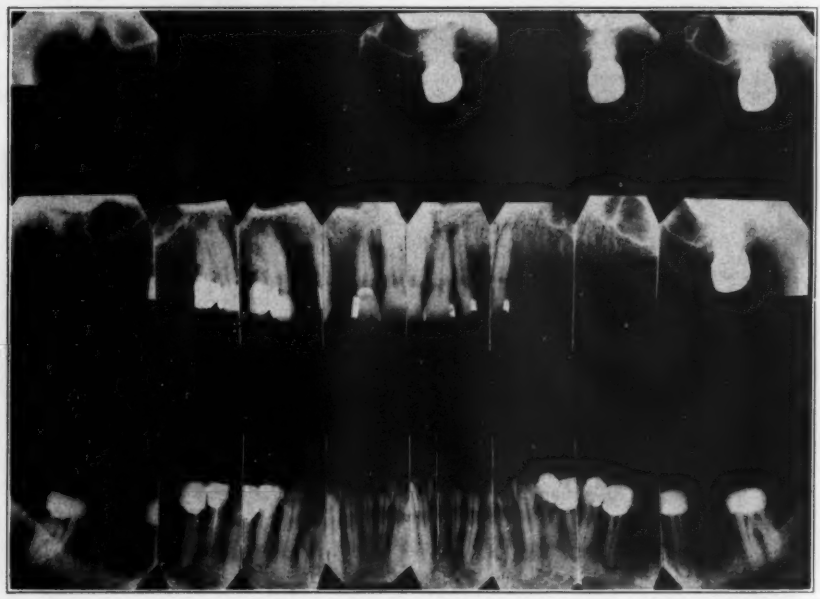

Fig. 4 (Case 1).—Hypocalcified bone.

It may seem superfluous to introduce to an informed group the case of hypocalcification shown in Figure 2, which warrants interpretation in terms of cal-

1. Key, J. A.: Factors in Atrophy of Bone, J.A.D.A., 17:1661 (Sept.) 1930.

cium deficiency and poor prosthesis. Yet these are factors in this end-result. The presence of an occluded maxillary full denture and mandibular partial denture, with lingual bar and clasps lodged on hypocalcified bone, has caused the loss of the bicuspids and has produced localized absorption in bone already undergoing atrophic change. Pressure atrophy might have been avoided if established basic mechanical principles were not ignored.

riods, atrophic changes present a hazard. Under bridges, vertical and lateral disuse atrophy results in the formation of a thin, high sharp ridge, which, if not removed surgically, militates against later full and partial tissue-borne devices. (Figs. 2-3.) These cases have been more fully described in former studies. Faulty exodontic procedures in the presence of hypercalcified bone may result in the detachment of the tuberosity and the max-

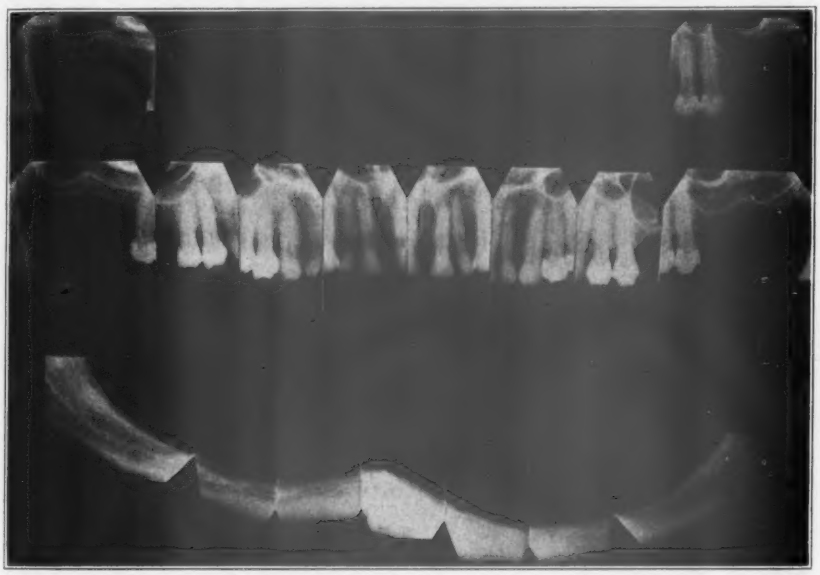

Fig. 5 (Case 2).—Hypocalcified bone.

No therapeutic measure had been instituted in this case.

The case shown in Figure 3 represents the opposite of its immediate predecessor. In both, there may be disastrous clinical experiences. In the former, rebasing can always be anticipated. In this hypercalcified bone type, osseous changes requiring rebasing are negligible. Over long pe-

illary third molar, causing exposure of the antrum. Intermittent pressure from functional opening and closing of the mandible on high fillings or on an isolated tooth causes bone apposition and hypercementosis. Its close-meshed and well-mineralized trabeculae give to the picture its characteristic appearance of hypercalcification. This bone type is

ideal for tissue-borne devices in replacement of lost natural teeth and in cases requiring reconstruction.[2]

REPORT OF CASES

CASE 1 (Fig. 4).—Miss H., aged 48, in December, 1933, required a full maxillary and partial mandibular denture. At the time, she expressed satisfaction with the prospective loss of her teeth, stating that her dental troubles would then be over.

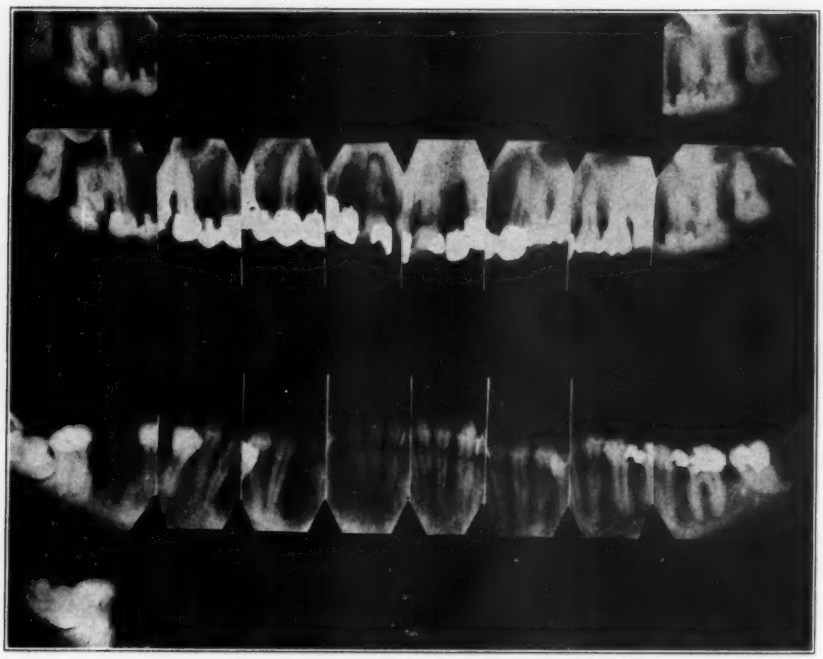

Fig. 6 (Case 3).—Alveolar bone.

When the calcium deficiency and rebasing phase of the case were explained, the patient acceded to suggested medical treatment. An interesting sidelight revealed that the case, a few years before, had been diagnosed as an "acid mouth condition." A proprietary alkaline substance had been prescribed. An acne of the cheeks, nose and forehead that followed was ascribed to its use, and the condition was diagnosed as achlorhydria, by the internist. The patient's endocrine status was diagnosed as a thyroid-ovarian deficiency type. The basal metabolic rate was 23.0 minus. Thyroid and ovarian extract by mouth and injections of ovarian extract were prescribed.

The general condition improved and the skin condition slightly improved. The principal change was in decreased fatigue.

On the dental side, the surgical preparation of the mouth was standard and the impressions were of plaster to obviate overcompression of the tissues. The cases were

2. McKevitt, F. H.: Atrophy and Hypertrophy of the Maxillary and Mandibular Process and Their Effect on Stability of Artificial Dentures, J.A.D.A., 19:424 (March) 1932; Clinical and Roentgenographic Manifestations of Atrophic Changes in Jaws: Endocrine and Vitamin Factors in the Practice of Prosthodontia, ibid., 19:1901 (Nov.) 1932.

mounted on an adaptable articulator and the trying in equalized. To date, there is no evidence of denture instability. The elapsed time is too short to make any positive assertion from the standpoint of calcium fixation, but beneficial results achieved have justified the dentomedical procedure.

CASE 2 (Fig. 5).—Mr. B., aged 42, had a costly metal partial maxillary denture, used in conjunction with a full mandibular denture. Because of the rapidity of osseous changes in the jaws, both dentures soon lost stability. The remaining maxillary teeth were removed and the patient was referred to the internist for treatment in October, 1933. In July, 1934, because of continued osseous changes, a new mandibular denture was made. To date, there have been no difficulties resulting from denture instability. Attention is directed to the vertical dimension of the mandible in the right and left molar regions, also to the vertical dimension of the maxillary process in the molar region and the relation of the antrum line to the crest of the maxillary ridge as evidence of osseous changes in the process.

The internist reported a slightly high basal metabolic rate of 14 (plus), but no other signs of hyperthyroidism. The impression is that the patient is primarily a calcium deficiency type. He has many indications also of suprarenal deficiency. He was given haliver oil and small doses of thyroid and epinephrine daily.

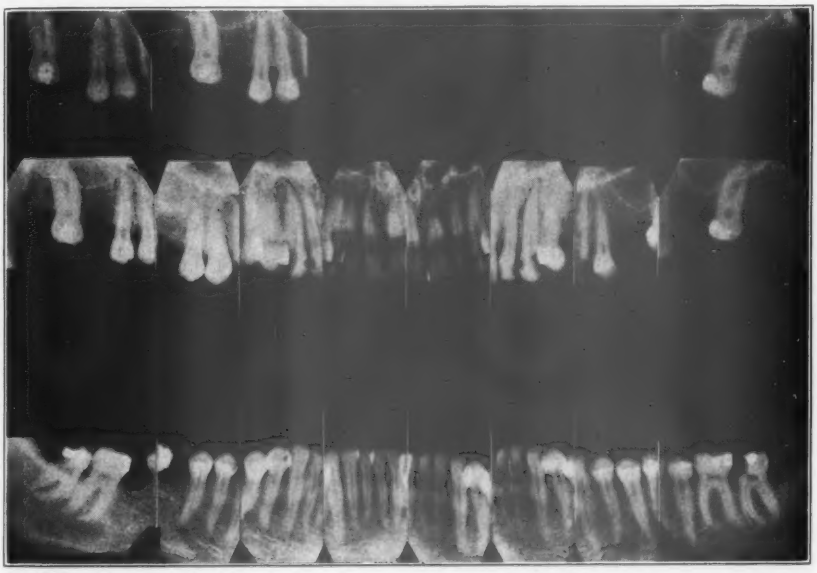

Fig. 7 (Case 4).—Hypocalcified bone; case referred to internist and diagnosed as biglandular thyro-ovarian deficiency.

Unquestionably, the condition described has contributed to the failure of good prosthetic restorations. The insidious action of osseous changes in this hypocalcified bone type militates against uniform success in this field. Any attempt at arresting atrophic changes and at calcium fixation in this and similar cases seem justified.

CASE 3 (Fig. 6).—Miss T., aged 26, in August, 1933, had the right maxillary molars, central and lateral incisors, left bi-

cuspids and first molar extracted. The mandibular right molars, second bicuspid, the left bicuspid and the first molar also were extracted. A temporary maxillary partial denture was used for six weeks. The final restoration, with mandibular and maxillary tissue-borne partial dentures, was then made. At the time of the initial visit, the patient complained of receding and bleeding gums, decay of the teeth and malodorous breath. Her health was reported good otherwise except for a slight loss of weight.

inclined to be dry, the hair oily. The reflexes were normal.

The patient was given glandular extracts, which she discontinued after six months. A year later, several teeth showed evidence of decay and were filled.

In May, 1936, the patient, who was a university student, stated that she thought the glandular therapy was of no value, but that she began to improve immediately after the extraction of her teeth. To date, the partial restorations show no signs of instability, and the patient is beginning to

Fig. 8 (Case 5).—Delayed dentition: chronologic age, 8 years and 6 months; bone age, 6 years, corresponding with dentition age.

To forestall rebasing, she was referred to the internist, who reported a basal metabolic rate of 2.2 minus, which is within normal limits. The examination revealed that the patient was quite thin and that the chest showed moderate muscle wasting. The tonsils had been removed. The thyroid showed enlargement, especially the isthmus, which is attached to the larynx and moves with swallowing. The skin was

break the teeth from the vulcanite. She has developed into a wiry person interested in swimming and hiking. It seems reasonable to presume that the extraction of the infected teeth, followed by better food assimilation after their restoration, along with the glandular therapy, has improved the general metabolism and obviated rebasing of the dentures because of calcium fixation.

Breaking the teeth from the vulcanite in this case should be regarded as verification of such a presumption.

CASE 4 (Fig. 7).—Miss G., aged 27, wished to have her teeth removed because, as she expressed it, they would not hold fillings. She gave a history of a dentition delayed until 9 years of age. The eruption of the central and lateral incisors was completed during her thirteenth year, a recognized symptom of hypothyroidism.

Dental roentgenograms taken in February, 1936, indicate a calcium deficiency. To obviate rebasing, it was thought appropriate therapy for the period of a year might improve the general metabolism and aid calcium fixation. The patient, a registered nurse, acceded to medical examination. The internist's report in part is as follows:

"The complaints are (1) dental decay, (2) sinus infection and (3) fatigue. The family history is negative from the endocrine standpoint. The basal metabolic rate is 13.5 minus. The impression is that she has thyroid myxedema and ovarian deficiency. She also has slightly lowered hemoglobin and red count, but this is probably due to lack of proper food absorption and distribution."

A résumé of historical dental incidents of her own recording are germane to this discussion. She states: "Since the age of 9, I have had constant dental care. Fillings would become loosened because of enlarging cavities that were not aided by various methods of dental hygiene. Treatment of my teeth has been at great expense without any improvement. At 16 and 18 years, I was treated for slight hypothyroidism. At 21, an ovarian cyst was removed. At this time, a slight hypothyroidism still existed,

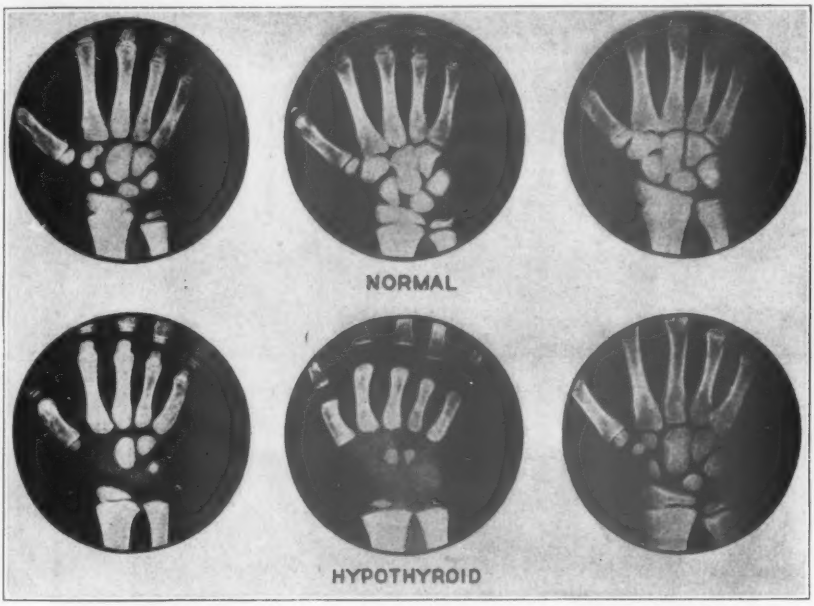

Fig. 9 (Case 5).—Comparison of normal carpal development at 6, 8 and 10 years with that in hypothyroidism at same ages; method of determining bone age used in case of delayed dentition. (From Engelbach's "Endocrine Medicine.")

Fig. 10 (Case 6).—Generalized osteoporosis with root resorption.

Fig. 11 (Case 6).—Calvarium in case of generalized osteoporosis.

but no glandular treatments were given. Since that time, my dental difficulties have been doubled. An acute sinus condition developed causing me to lose at least three months' employment a year. Constant fatigue and irritability has completely cut me off from normal living in the past two years. Three months ago, at the suggestion of the dentist, I consulted a physician. Examination revealed a definite glandular insufficiency. Thyroid and ovarian extract and pituitrin whole gland were prescribed. Since then, my condition has greatly improved. Fatigue has greatly lessened; my weight is gradually returning to normal, and the acne condition has improved to a great extent. Acute flare ups of constant sinusitis have lessened from one in every two weeks lasting from two to three days, to one in three months of three days' duration. My physical ability has become almost normal."

Fig. 12 (Case 7).—Parathyroid osteosis.

Further operative procedures in this case have been postponed purposely in an attempt at calcium fixation. There would be no point involved in its presentation here but for the history of delayed dentition, the early recognition of which, if interpreted in the light of present knowledge, might have forestalled the existing condition. In a measure, it parallels the case to follow, which is intended to illustrate one manner of approach to the study of early osseous changes in the jaws.

Case 5 (Figs. 8-9).—Because of delayed

dentition and a tentative diagnosis of hypothyroidism, this case was referred, Feb. 3, 1933, to the internist, whose first report stated:

"The diagnosis is by no means obvious. The patient is so energetic that one would be tempted to exclude the possibility of hypothyroidism. Nevertheless, a study of the ossification status confirms the findings of the dentist with regard to delayed dentition, since the bone age is only 6, and the chronologic age 8 years, 6 months. The patient has, therefore, actual osseous retardation as well as shortness."

Fig. 13 (Case 7).—Lateral and anteroposterior views of leg bones at knee, showing leeched out appearance of bones in case of parathyroid osteosis.

A report dated March 12, 1934, stated:

"The patient was placed on small doses of thyroid and has grown in the past year 2½ inches, and has gained correspondingly in weight. The metabolism at the time of the original visit was 3.2 minus, and Dec. 8, 1933, was 3.6 plus, both of which are within normal limits."

A report dated Feb. 19, 1936, states:

"From March, 1934, to January, 1936, the patient grew 3½ inches, which is a normal rate of growth. Altogether, since he first came to us in February, 1933, when his height was 45⅞ inches, he has grown 6 inches. He is under regular observation and I am sure his thyroid status is well under control." (Hans Lisser, M.D.)

Discussing retarded bone development, Shelton states[3]: "Tissue differentiation from the beginning of the fertilized ovum until the completion of somatic development is dependent upon body metabolism. In no other manner is the speed of metabolism presented so graphically as in osseous (particularly carpal) development." Bone age comparisons are shown in Figure 9.

Case 6 (Figs. 10-11).—Mr. L., aged 22, had been referred for dental treatment by the orthodontist, Jan. 22, 1927. Two films were used for roentgenologic study. These are shown in the center of the upper row in Figure 10, the unerupted crowns of the maxillary right and left third molars being evident, with marked root absorption of the maxillary first and second molars and the second bicuspids. Seven years later, February, 1934, when this case came to my attention, a complete roentgenologic study was made of the entire dentition. Attention is called to the hypocalcified appearance of the alveolar bone, to the new positions of the maxillary third molars and also to the appearance of the roots of the superior maxillary second molar (left), for comparison with the earlier roentgenograms. The resorption of the roots and the vitality of the teeth are comparable to those conditions in the deciduous teeth. The patient was referred to the internist and he refused treatment. Decay was still rampant. The right maxillary first and second molars were extracted May 10, 1935.

From roentgenologic study of the long

3. Shelton, E. K.: Osseous Development as Index of Metabolic Speed, Endocrinology, 17: 667 (Nov.-Dec.) 1933.

bones and the calvarium, which is shown in Figure 11, the case was thought to be one of parathyroid osteosis, but as the blood chemistry picture was normal, this theory was excluded. In view of subsequent study, the case was regarded by the internist as one of generalized osteoporosis, due to either food or vitamin deficiency. The diagnosis by Ralph Reynolds, M.D., carries an implied note of caution, aptly expressed by Camp,[4] who states:

CLASSIFICATION OF MALACIC DISEASE OF BONE*

Group 1. Atrophy associated with:	
Disuse	Neurotrophic disorders
Fractures	Circulatory disorders
Arthritis	
Group 2. Congenital defects	
Osteogenesis imperfecta	
Fragilitas ossium	
Group 3. Dietary insufficiency and avitaminosis	
Rickets	
Osteomalacia	
Puerperal	Celiac disease
Senile	Chronic idiopathic steatorrhea
Hunger and war deficiency	Kashin-Beck disease
Group 4. Renal insufficiency	
Renal rickets	
Group 5. Endocrine malfunction	
Hyperparathyroidism	Suprarenal disease
Hyperthyroidism	Diabetes mellitus
Cushing's syndrome (basophilism)	
Group 6. Miscellaneous: Etiology unknown	
Focal osteitis fibrosa cystica	
Osteitis deformans (Paget's disease)	

*Table 1 from Camp (Footnote 4).

"Because of the multiplicity of conditions that may affect the mineral content and structure of the skeleton, the early recognition of any particular disease by roentgenograms alone may be exceedingly difficult. Even in some advanced lesions, the ultimate diagnosis can be made only by proper correlation of the clinical data and other laboratory findings.

"Without doubt, the present intensive clinical and investigative work that is being carried out on the subject of hyperparathyroidism and mineral metabolism in general will have a far-reaching effect on our knowledge and classification of certain forms of lesions of bone. With a full realization of this situation, the classification in Table 1 is offered, subject to revision. It does offer, to my mind, at the present time, however, a reasonable basis for consideration of the roentgenologic changes in the various forms of malacic disease of bone."

In the classification of malacic diseases of bone by Dr. Camp, it is significant that of the six groups, five are concerned with nonendocrinopathy.

Because of their rarity, dental studies of parathyroid osteosis or parathyroidism are difficult to secure. They are usually discovered in the chronic stage by the physician, whose bone studies do not, as a rule, include alveolar bone. It is hoped this order will be reversed by the early discovery of cases through dental roentgenograms when early diagnosis would be most advantageous.

The recognized function of the parathyroid glands is to maintain the calcium level in the blood stream at from 9 to 11 mg.

The disease is due to a functionary adenoma of the parathyroid glands. As a result of increased production of the hormone, there is a disturbance in the metabolism of calcium and phosphorus, which results in generalized structural changes in the skeletal system with a corresponding rise of calcium and a lowering of phosphorus in the blood stream, accounting for the leeched-out appearance of the bones in the roentgenograms.

CASE 7 (Figs. 12-13).—The internist's report of this case was as follows:

4. Camp, J. D.: Roentgenologic Changes in Malacic Diseases of Bone, California & West. Med., 41:152 (Sept.) 1934.

"At the beginning of 1933, the patient noticed a disturbance of the left knee. The left leg became gradually weaker and there was pain in the left knee joint. The film revealed marked decalcification of the bones around the left knee joint extending upward into the femur and downward into the tibia and fibula. In the Fall of 1934, the blood calcium was high (15 mg.) and blood phosphorus was low (2.0 to 2.5 mg.). A few months later, the patient had the left parathyroid gland removed, and an immediate drop in blood calcium and elevation of blood phosphorus resulted. Since then, there has been considerable improvement in the character of the bone. I placed the patient on an anterior lobe extract and theelin injections and prescribed thyroid, pituitary and ovarian extract by mouth. The general condition has gradually improved since this time. She is now beginning to walk slightly on the left leg and has been swimming considerably during the past few months." (Ralph Reynolds, M.D.)

CASE 8 (Figs. 14-15).—The osseous change in the alveolar process, shown in Figure 14 (a roentgenogram from the extensive library of Leonard Frank, dental roentgenologist), a case of Paget's disease, demonstrates the opportunity presented through dental roentgenograms of detecting early cases of Paget's disease that may have escaped medical observation, and which obviously belong to the province of medicine, to which they should be promptly turned.

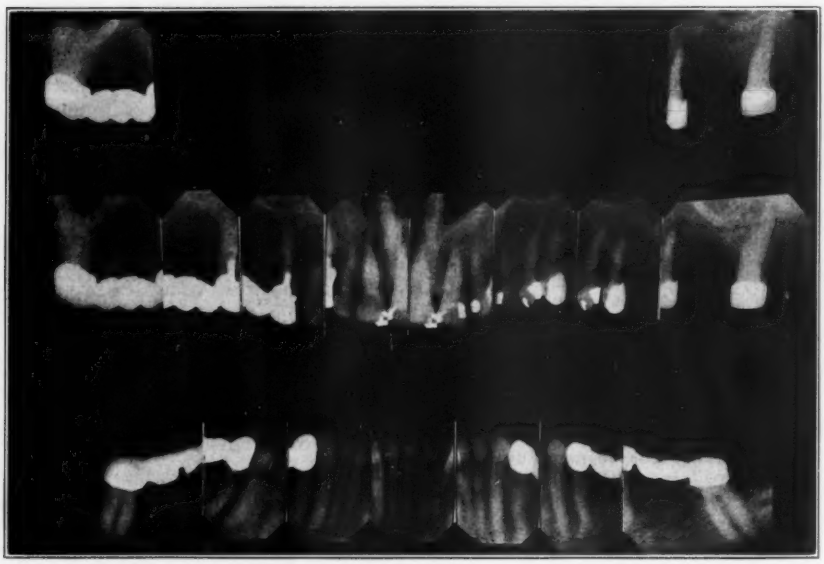

Fig. 14 (Case 8).—Alveolar process in Paget's disease. (Compare blurred appearance of trabeculae with appearance of skull in Figure 15.) The striated bone in the maxillary molar region is to be noted.

The blurred appearance of the trabeculae and the striated bone in the maxillary molar regions warrant further study of the flat bones and particularly of the skull, as shown in Figure 15.

In a discussion of Paget's disease, Wilder writes[5]:

"Paget, in 1877, called attention to the chronic inflammatory disease of bone that affected persons of middle age and old age, and which was characterized by thickening and bending of the bones. This osteitis deformans of Paget has been shown recently not to be associated with any abnormality of the parathyroid glands, nor with any disturbances of the metabolism of calcium. Spontaneous fractures in this condition are rare, and removal of parathyroid glands is without benefit; nevertheless, Paget's disease was confounded, in its turn, with parathyroid osteosis so that the two conditions

Fig. 15 (Case 8).—Anteroposterior view of skull in Paget's disease.

were taken up as subtypes of a common fibrocystic osteitis in the publication of von Recklinghausen in 1891, and are so regarded to this day by some writers."

Figure 15 shows the skull of the same patient. It is a companion picture to that of alveolar bone in Paget's disease, and intended for roentgenographic comparison with illustrations of the long bones in parathyroid osteosis or hyperparathyroidism.

In Paget's disease (or "osteitis deformans"), there is a tremendous absorption of bone associated with tremendous apposition, which completely alters the normal architecture, although apposition predominates.

Crude as initial dental attempts at diagnosing these conditions may be, the importance of calling them to the attention of the internist and enlisting his cooperation in their diagnosis and treatment is evident, if calcium fixation is to be achieved. Danger lies, not from overenthusiasm, but from ultraconservatism. There is much to gain and nothing to lose.

GOTHIC ARCH TRACING

In conjunction with the foregoing report, I wish to say that, in accordance with my belief, atrophic changes in alveolar bone upon which full and partial replacements are to be lodged will be delayed if fundamental principles of exodontia and prosthodontia are adhered to. These include (1) surgical preparation of alveolar ridges; (2) return to the use of plaster or its equivalent for impressions; (3) maintenance of the original vertical dimension established by the natural teeth[6]; (4) equalization of occlusal rims when centric relations of the jaws are registered, and again later, when the artificial teeth have been tried in the mouth, and (5) proper consideration of the elementary movements of the mandible, and the selection of a suitable articulator. While no specific method of calcium fixation has as yet been evolved for the great mass of full or partial denture wearers, unfavorable clinical experiences can be minimized by following the precepts of teachers who have preceded us.

5. Wilder, R. M.: Diseases of Parathyroid Glands, Internat. Clinics, Vol. III, Series 43.

6. McKevitt, F. H.: Recovery of Lost Dimension, D. Digest, 36:423 (July) 1930.

A study of the Gysi gothic arch tracings (Fig. 16), recorded for full denture cases, is intended to indicate graphically to the partial denture prosthetist a point with which he is no doubt familiar.

CONCLUSION

Nothing can be more conducive to a better understanding of general dentistry and its various specialties than a study of the physiology of the ductless glands as it is revealed in the vast medical and dental literature of today. Endocrinology is making such rapid progress that it has already overthrown many of the older ideas of dental physiology, pathology and therapy. It is because our present knowledge is so indefinite that every dentist has it within his power to sharpen diagnostic acumen and add to the common store of information. If we can understand the rôle the ductless glands play in the processes of growth and structural integrity of the body from birth to maturity, we may better appreciate why teeth and jaws develop normally, and also why they deviate from normal processes.

Though the teeth and jaws limit our field of endeavor, the bone, blood, tissue, cementum, dentin and enamel make a study of calcium and phosphorus metabolism imperative. Our interest in mineral metabolism, the rôle of the vitamins and the effect of ultraviolet irradiation on the human economy is comparatively recent, and should be studied in conjunction with ductless gland therapy. We are unquestionably approaching a stage in our knowledge when this will be necessary. Though the teeth and jaws are not the seat of glandular dysfunction, they afford roentgenologic and clinical evidence which, if properly interpreted,

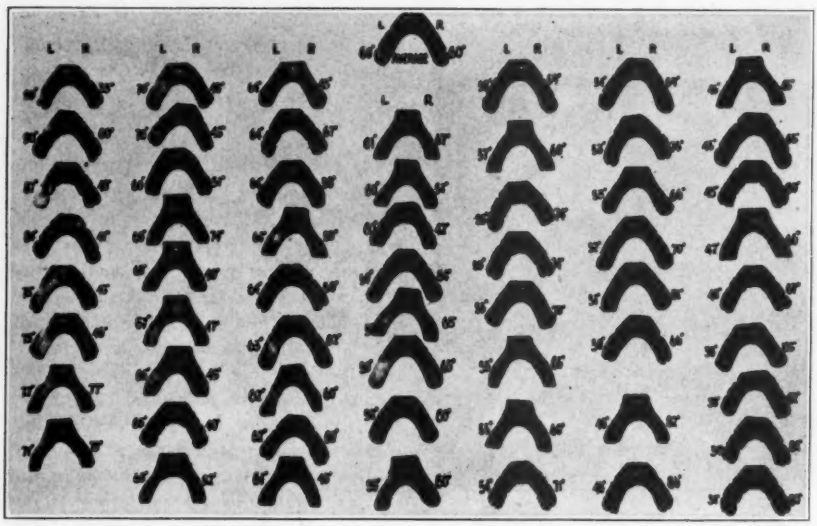

Fig. 16.—Sixty gothic arch tracings showing in degrees variations from 60 degree average of lateral right and left mandibular movements in horizontal plane.

will not only lead to proof of a hormonic imbalance of the ductless glands, but also to other causes of malacic diseases of bone, which have an important bearing on osseous changes in the alveolar process and their effect on the stability of full and partial dentures.

450 Sutter Street.

PREVENTIVE ORTHODONTICS*

By R. C. WILLETT, D.M.D., F.A.C.D., Peoria, Ill.

IN general medical and dental science, of which orthodontia is a highly specialized division, constant investigation is in progress concerning the origin of physical disorders, with the ever-increasing prospect that their treatment will become more effective and the frequency of their occurrence ultimately lessened.

The problems that confront us in preventive orthodontics are not in all instances of pathologic origin. Generally speaking, many of them are obscure, their origin sealed in the mystery of heredity, the morbid factors of which in one way or another reflect on growth development of the body as a whole, but frequently with more pronounced manifestations in the oral ensemble.

To simplify their classification and study, conditions that are detrimental to normal growth and development may be divided into the intrinsic and extrinsic groups.

1. The intrinsic group includes all morbid factors that are inherent in the formation of the organism and, unassociated with other causes, determine the type of deformity.

2. The extrinsic group includes all environmental or acquired injurious influences arising during the life of the organism, and the extent to which growth development and function may be disturbed by such conditions depends much on the latent activity of morbid factors comprising the intrinsic group.

It is impossible here to stress adequately all the prophylactic measures that the family dentist, the specialist in restorative dentistry for children or the orthodontist might effectively apply in controlling the factors in both groups. I shall therefore present only outstanding factors in the extrinsic group that contribute in varying degrees of intensity to the onset of malocclusion, and offer for discussion methods of operative and prosthetic technic applicable to their control.

GROWTH AND DEVELOPMENT OF THE DECIDUOUS DENTURE

With some reservations in regard to a definite age representing a uniform level of growth and development, it may be reasonably assumed that, at the age of 30 months, the normal, well-nourished child who has suffered from no misadventure of health should have twenty functioning deciduous teeth.

Immediately after the eruption of the deciduous teeth, there is no space posterior to the second deciduous molars for the eruption of the first permanent

*Read before the Section on Children's Dentistry and Oral Hygiene at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 14, 1936.

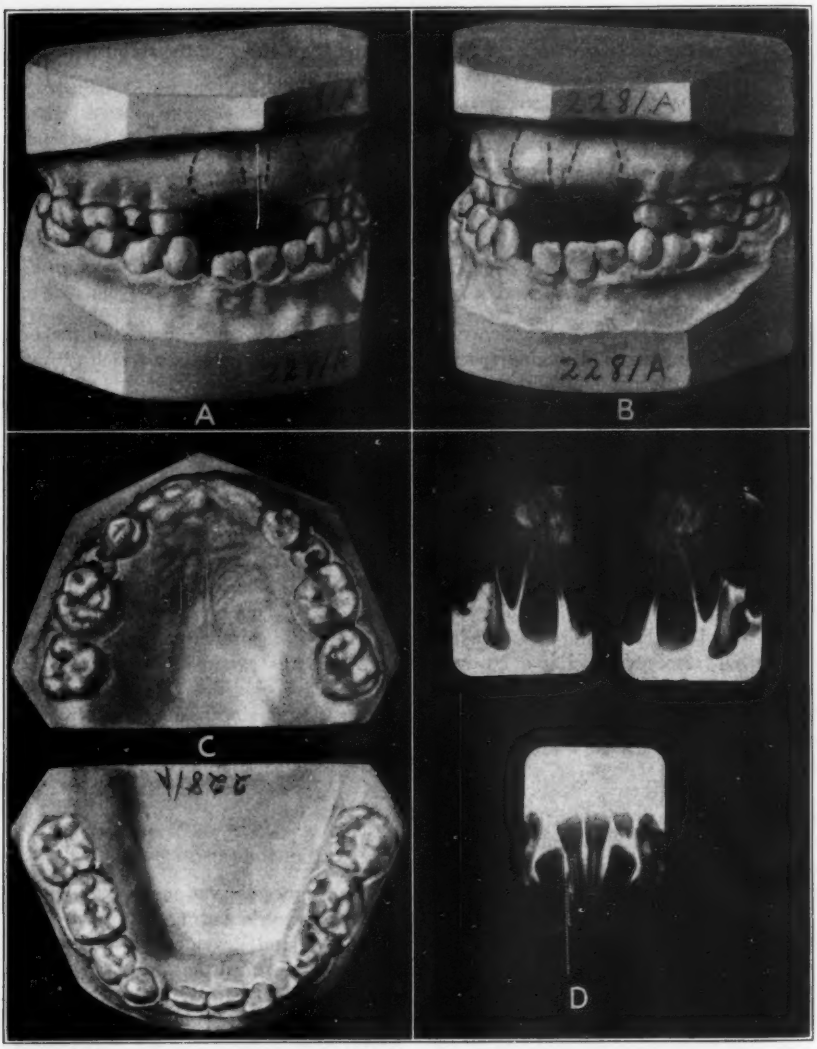

Fig. 1.—Anterior collapse of maxillary arch attributed to defects of first deciduous molars.

molars, and the deciduous molars are not in proximal contact.

There is little dimensional change in the deciduous denture prior to the initiation of nature's provision for the eruption of the first permanent molars, with the exception of a slight lateral growth from cuspid to cuspid, the closing of spaces be-

tween the deciduous molars and spacing between the incisors. This minor dimensional change in the denture is by no means sufficient to afford the required space for the first permanent molars. Space for them is developed principally through growth of the jaws that takes place posterior to the second deciduous molars in the maxillary tuberosities and the mandibular retromolar triangles, which receive growth stimuli through the developing permanent molars. Provided the mesiodistal diameters of the deciduous teeth have not been impaired by caries or traumatic injuries (with special reference to the molars and cuspids) and the teeth are all retained for the normal period, the denture moves forward *en masse* until ample space for the first permanent molars has developed.

Fig. 2.—Onset of anterior collapse of mandibular arch attributed to defects of first deciduous molars.

Because nature has chosen this method of space extension, it is inevitable that, prior to and at this particular period of development, the slightest alteration of a proximal contact between a first and second deciduous molar or between a first deciduous molar and cuspid is capable of disturbing the forward growth of the denture.

The basic conditions underlying the pathologic processes manifested in the occurrence of proximal caries in the deciduous teeth, and premature loss of them from various acquired conditions other than trauma, present a problem that as yet has not been accorded competent and thorough investigation. As a consequence of their remaining obscurity, many diversified opinions have been expressed concerning the ultimate effect on adult occlusion of the acquired defects of deciduous dentition.

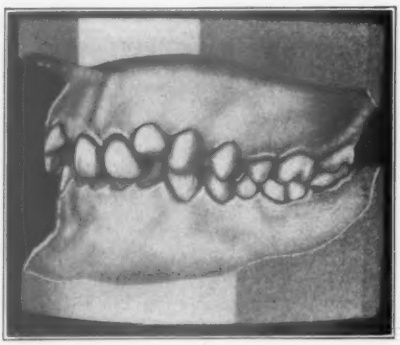

Fig. 3.—Anterior collapse of dental arches attributed to defects of mandibular first deciduous molars when muscular tension of lips is normal.

In 1,000 recorded cases of middle-class children from prekindergarten age to 10 years whose mouths were examined because of some dental complaint, the tabulations and casts showed that 28.8 per cent had suffered from the partial or total loss of one or more deciduous teeth of the buccal segments. These acquired injurious conditions included ill-advised extractions of deciduous teeth because of

the operator's belief or the parent's persuasion that the permanent teeth would have more space in which to erupt.

Investigation and study of these records and hundreds of other similar cases have demonstrated the fact that the effect of functional impairment of a certain deciduous tooth, or even a series of them, on one particular child differs widely from the effect of the same loss of function in the case of another child of the same age or state of dentition.

A few exceptional cases are usually found in a large group of mouth examinations; and the reexamination of these exceptional cases demonstrates the persistency of certain intrinsic factors inherent in the organism which make for normal growth and development in spite of acquired injurious influences. Despite these exceptional instances of apparently normal dentition after the premature partial or total loss of one or more deciduous molars, it by no means follows that such loss is a matter of small importance or one calling for less than the best professional skill and judgment. The fact remains unquestionable that bone growth and muscular force cannot be so evenly developed nor so symmetrical as in the case of the child who sustains no such losses.

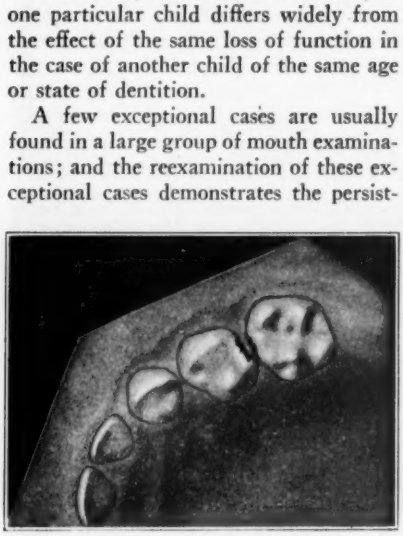

Fig. 4.—Proximal caries frequently found in first and second deciduous molars.

The case of Mildred M., aged 8 years at the time of introduction, is a representative clinical example of arrested anterior-posterior dental arch growth and onset of malocclusion that can be reasonably attributed to acquired injurious influences. (Fig. 1.)

In arriving at such a conclusion, it was necessary first to learn the immediate family history, with the facts regarding the child's physical condition at birth and the possibility of nutritional disturbances having occurred during infancy.

It was found that physically the parents qualified under the laws of eugenics and that at birth this child and a brother two years younger measured up to such requirements.

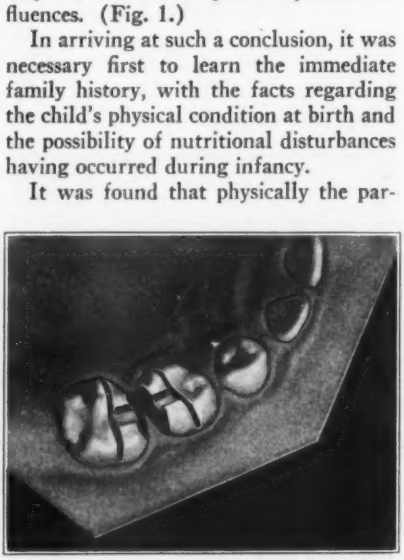

Fig. 5.—Slice cavity preparation for indirect method of making hard gold alloy inlay restorations for deciduous molars.

Up to the third year, no misadventure in health occurred and the patient's growth and vigor were all that could be expected. Some time between the third and fourth years, she became "finicky," as the grandmother expressed it, about the foods that she had formerly relished. There was a loss of weight, and a marked decline in general health. As recounted

by the mother, in the search that was made for the underlying cause of the child's sudden decline in health, a mouth examination disclosed the fact that she had some defective teeth. The family physician ignored the occurrence of caries in the deciduous teeth as significant of a syndrome of systemic disturbances, and, unfortunately, the dentist to whom the parents referred for advice informed them that "gumboils" did no harm so long as they drained and that teeth so affected should be retained to hold space for the permanent ones.

From the examination that was made of the child's mouth at the age of 8 years, it was evident that the dentist's advice concerned distoproximal cavities in the maxillary first deciduous molars that had terminated in alveolar abscesses. From further study and analysis of the case, it was evident that proximal structural defects did not occur in the mandibular deciduous molars until much later on. The occlusal relationship of the second deciduous molars and first permanent molars indicated that intermolar arch growth had not been materially affected. The arrested growth and collapse of the maxillary arch were anterior to the second deciduous molars and were primarily due to impaired function and lip pressure. Pressure of the upper lip had carried the maxillary deciduous cuspids distally and lingually in just proportion to the diminished mesiodistal diameter of the first deciduous molar crowns.

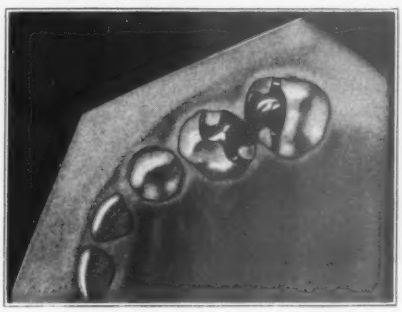

Fig. 6.—Inlays seated in prepared cavities.

The dotted lines on the model show the position of the maxillary central incisors, and reveal that, as a consequence of reduction of the intercuspid arch width, there will be malalinement of the lateral incisors and cuspids when they erupt. This prediction is further confirmed by the roentgenograms, which clearly show the rotated positions of the unerupted lateral incisors.

The intermolar width of the mandibular arch is within normal limits, but because of the structural defects of the maxillary first deciduous molars and the general collapse of the arch anterior to them, there is intercuspid collapse in the mandibular arch, a secondary effect arising from impairment of function and lip pressure. The roentgenogram shows that the unerupted mandibular lateral incisors are in fair alinement, but their normal course of eruption will be interfered with because of deficiency in intercuspid arch width.

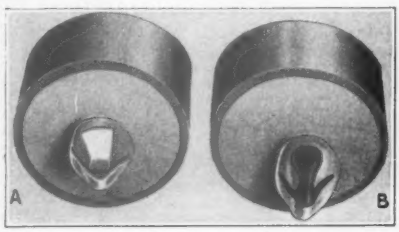

Fig. 7.—*A*, cavity preparation involving proximal surface of deciduous cuspid. *B*, inlay seated in prepared cavity.

After a review of a study of inhibited growth in a deciduous denture and the onset of malocclusion that undoubtedly originated because of carious maxillary

first deciduous molars, it should be interesting to review the cases in which inhibited growth of the denture and onset of malocclusion originated because of caries of the mandibular first deciduous molars.

In the case of Betty S. (Fig. 2.), aged 11 years at the time of introduction, investigation proved that the mandibular first deciduous molars had been hopelessly carious and infected and were extracted early in the fifth year. While the health record was not clear, there was nothing to indicate that injurious inherent factors seriously clouded a case analysis. It was an established fact that prior to the premature loss of the mandibular first deciduous molars, occlusion was normal. The maxillary deciduous molar proximal contacts were unimpaired by caries and, through the urge of growth, centralized in developing permanent molars, forward growth in that half of the denture was unchecked.

The injurious effect resulting from the loss of the mandibular first deciduous molars was immediately registered. The developing permanent molars carried the second deciduous molars forward until they partially occupied first deciduous molar space. At the same time, anterior mandibular growth was not only retarded, but when the incisors failed to meet in centric occlusion as they formerly did, the way was opened to lip biting. The lip biting habit once established, there was a posterior drift of occlusion and, at the same time, the maxillary anterior teeth were caused to protrude.

A reverse type of malocclusion may result from a partial or total loss of one or both mandibular first deciduous molars when the muscular tension of the lips is normal. (Fig. 3.) Under such circumstances, there is a collapse of both dental arches, the anterior segment of the maxilla following the mandibular one. The overbite of the maxillary incisors becomes more pronounced when the permanent ones erupt, being malalined and overlapped as shown in Figure 3.

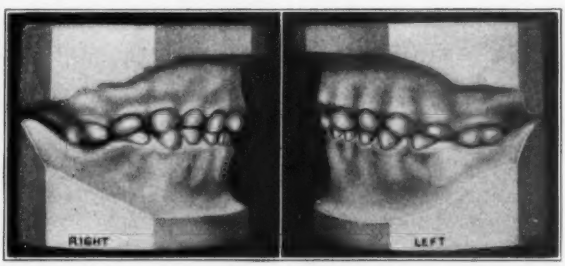

Fig. 8.—Occlusal malalinement of maxillary second deciduous molars due to premature loss of mandibular second deciduous molars.

The partial or total loss of a second deciduous molar prior to the eruption of the first permanent molar, or during the transition period from deciduous to permanent dentition, may account for the onset of distinctive types of malocclusion. The developing permanent molar drifts forward and the space for the eruption of the second bicuspid is partially or wholly closed. At the same time, the first permanent molar rotates lingually. Occasionally, the closed space opens, and the second bicuspid erupts in normal alinement, but such cases are rare in com-

parison to those in which it either erupts in some degree of malalinement or becomes permanently impacted.

Although briefly stated, the foregoing explanation of how the deciduous denture develops under normal conditions, and the introduction of clinical examples showing that proximal caries involving the mesiodistal diameter of a deciduous molar is entirely capable of producing malocclusion, are sufficient proof that both the dentist and the parent should appreciate the fact that effective control of such defects is a matter of first importance in operative dentistry.

The growing recognition of the need of an improved technic that would apply directly to the operations involving proximal surfaces of deciduous molars and cuspids resulted in the devising of a method the prime objects of which were:

1. To avoid a complicated technic, i.e., that would be difficult to apply, employing a simple one that would conserve the nervous energy of the patient and the operator.

2. To avoid the making of undercuts, or box cavity preparation, for the retention of filling materials, since the anatomic variations of deciduous teeth differ from those of permanent ones, and such methods of cavity preparation endanger the pulp and weaken the cavity walls.

3. To restore and maintain anatomic form, with special reference to the mesiodistal diameter, which should allow full function and afford protection to the septal tissues.

4. To afford a more satisfactory anchorage for appliances in the event necessity for orthodontic treatment is indicated before root absorption has occurred.

Without entering into explicit details[1] of the technic, I present the accompanying illustrations as exhibits of what can be accomplished with much less of the operator's time consumed at the chair than is usually spent in attempting to fill such cavities in a creditable manner with plastic material.

Figure 4 shows proximal caries; Figure 5, the slice cavity preparation for proximal inlay restorations; Figure 6, the inlays as they appear when in place, and Figure 7, the same method applied in making restorations that involve the proximal surfaces of deciduous cuspids.

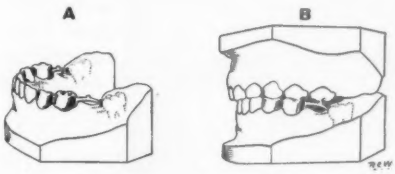

Fig. 9.—One piece space maintainer to control eruption of first permanent molar.

Fig. 10.—Controlling eruption of mandibular first permanent molar.

This method presents the following advantages:

1. The immediate stress of occlusion upon such an inlay when set has no tendency to dislodge it.

2. When it is first placed in the prepared cavity, there is no danger of crushing margins or of distorting the design of the form, which would impair full functioning of the teeth.

3. The slice cavity preparation is accomplished with little mutilation of tooth structure in a vulnerable area.

1. Willett, R. C.: D. Items Int., 53:489 (July) 1931.

4. The contact points are placed accurately without the use of a matrix, which may be uncomfortable.

5. The gingival margin is well finished in advance of setting, with no overhanging ledge irritating to the approximal tissues.

These advantages should carry an appeal to the conscientious operator.

The time factor in this technic will be found an economic measure, the operation taking less of an operator's time in the operating room than the making and polishing of a creditable plastic filling.

When this technic has been thoroughly mastered, it should not take a painstaking operator more than fifteen minutes to prepare two approximating deciduous molar cavities and take the modeling compound impressions. If time wasting and dilatory habits have not been formed by the operator or his assistant, the laboratory phase of this technic should not require more than from thirty to forty-five minutes. The time required for setting the inlays and covering them with tinfoil to protect the cement until set is from three to five minutes, provided everything is in readiness and all instruments and cement equipment are properly arranged before the child enters the operating room.

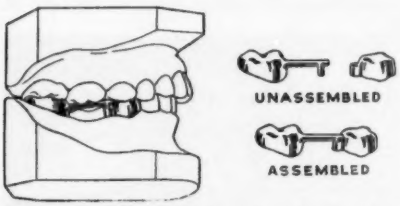

Fig. 11.—Semifixed bar functional space maintainer.

RESTORATION OF FUNCTION IMPAIRED BY PREMATURE LOSS OF DECIDUOUS TEETH

It is a clinically demonstrated fact that function of the deciduous teeth, once wholly or partially lost, can, in most cases, be successfully restored to the extent that growth of the dental arches and eruption of the permanent teeth are not seriously affected.

The ways and means by which such conditions are controlled will be shown through an orderly presentation of technical procedures as they have been applied in clinic and private practice.

Compensating for Loss of Second Deciduous Molars.—The first noticeable effect following the unattended loss of a second deciduous molar is the occlusal malalinement of the second deciduous molar in the opposing arch. In Figure 8 is shown a typical occurrence of this kind in the case of a boy, aged 4 years. After the loss of the mandibular second deciduous molars, the maxillary second deciduous molars dropped out of occlusal alinement, a malfunction that rendered the closure of the jaws painful being thus established.

Deplorable as the loss of a second deciduous molar prior to the eruption of the first permanent molar may be, there is a remedy for the all but inevitable consequences, if the remedy is applied in time. Its efficiency has been proved in many cases, and, in fact, when properly constructed, modified to meet conditions, and considerately used, it has resulted in nearer 100 per cent of desired results than have been obtained by the use of any other type of functional space maintainer in seemingly more favorable areas.

Figure 9 shows a one-piece cast device comprised of a combined overlay anchorage which covers the first deciduous molar and cuspid, and which has a distal extension that engages the mesioproximal surface of the unerupted first permanent molar. If the tissues have healed, access to the first permanent molar is gained by a slight operation which removes only a

sufficient amount of tissue to expose that area of the first permanent molar against which the distal extension of the overlay anchorage is placed. The distal extension is so formed that it also serves as an occlusal rest for the second deciduous molar of the opposing arch; which results in restoration of function and prevents that tooth from dropping out of occlusal alinement. This prevention and the restoration of function are fully as important as the interception of an anterior migration of the first permanent molar.

A question has frequently been raised concerning the effect of the force of occlusion on the posterior extension that controls the eruption of the mandibular first permanent molar. Theoretically, it would seem that the force of occlusion on the posterior extension would place an undue strain on the anchor teeth and cause them to tip posteriorly. Such a displacement of the anchor teeth has not been traceable to the extra burden placed on them. It has occurred only in cases wherein the deciduous molar had been affected by caries and the usual operative precautions against pulp involvement had failed, or in case of resorption of the cuspid root, which occasionally occurs during the seventh year.

The case of John A. (Fig. 10) shows the possibilities of prevention, interception and control in a mutilated deciduous denture. At the age of 6 years, this case presented a complication of dental afflictions. Caries and the ectopic eruption of the mandibular right first permanent molar had terminated in an alveolar abscess. Immediate removal of the second deciduous molar was necessary. To intercept further anterior drift of the first permanent molar, the type of one-piece cast space maintainer shown in Figure 9 was used. The roentgenogram *A*, was taken a month later to determine what effect the curved posterior extension might be having in controlling the eruption of the first permanent molar. *B*, made a year later, shows that not only occlusion of the first permanent molars was established, but also the force of mas-

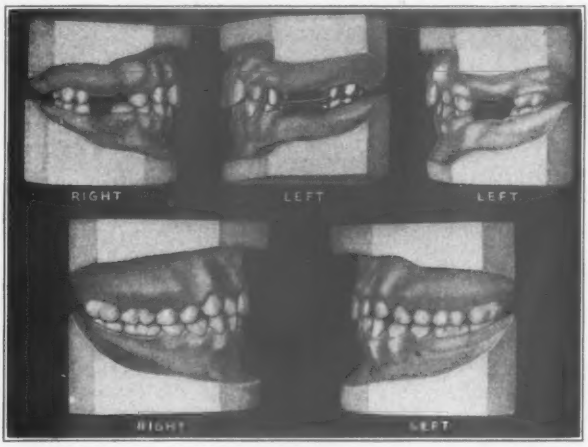

Fig. 12.—Function and dental arch form maintained with semifixed bar functional space maintainers.

tication had not affected the stability of the appliance.

After the eruption and occlusion of the first permanent molars, the space maintainer placed to control the eruption of the mandibular first permanent molar was replaced by a semifixed bar type of appliance, as illustrated in Figure 11.

The patient's dental afflictions did not end here. Owing to extensive caries, it became necessary to remove six deciduous molars. Function and dental arch form were maintained with semifixed bar space maintainers until the bicuspids were partly erupted. (Fig. 12.) The lower half of Figure 12 shows the condition of occlusion at the age of 13 years.

General Restoration of Function as a Preventive Orthodontic Measure.—In further proof of the advantages of thorough mouth treatment as a general as well as oral health service, the case of Maxine, aged 5½ years at the time of introduction, will be reviewed in detail. The patient was suffering from a systemic infection at the time she was referred for the care of her teeth. There had been a temperature above normal over a period of months. She had a tuberculous hip, the left leg having been in a plaster cast for eighteen months. This affliction was the supposed cause of the continuous fever. A major bone operation had been postponed because of this.

The seat of focal infection that appeared to be most active in the mouth involved the mandibular right and left second deciduous molars. The first permanent molars had not erupted. At the time of the first mouth examination, pus

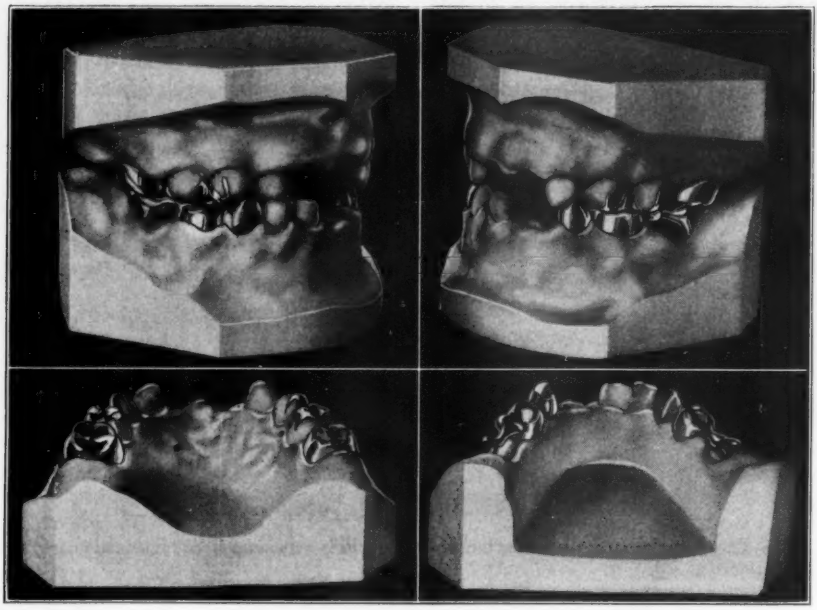

Fig. 13.—General restoration of function as preventive orthodontic measure in patient aged 5½ years.

was draining freely from the gingival tissues at the buccal and distal aspects of the teeth involved. There were numerous proximal cavities in other deciduous teeth, productive of pain and discomfort.

Directions were given for the immediate removal of the infected mandibular second deciduous molars, and as soon as the field was clear of infection, one-piece posterior extension type space maintainers were placed for the purpose of preventing anterior migration of the unerupted first permanent molars, and for the maintenance of function in the affected areas.

In the treatment of this case, another opportunity was afforded in which to demonstrate the value of the especially devised inlay and overlay restorations, which were made as indicated. The deciduous teeth thus restored are shown in Figure 13.

During the first ten days' treatment of the child's teeth, the temperature became normal and so remained. Since there had been no response to previous treatment, it is but reasonable to contend that the clearing up of the neglected dental foci and the establishing of comfortable chewing forces had something to do with bringing about a normal temperature and improvement in nutrition.

Conclusive proof that growth of the dental arches took place during the following ten months is shown in Figure 14. In a comparison of the casts made before function of the deciduous teeth was restored and those made ten months later, it was found that the anterior width of the dental arches had increased approximately 0.07 inch, and it will be observed that the one-piece cast space maintainers

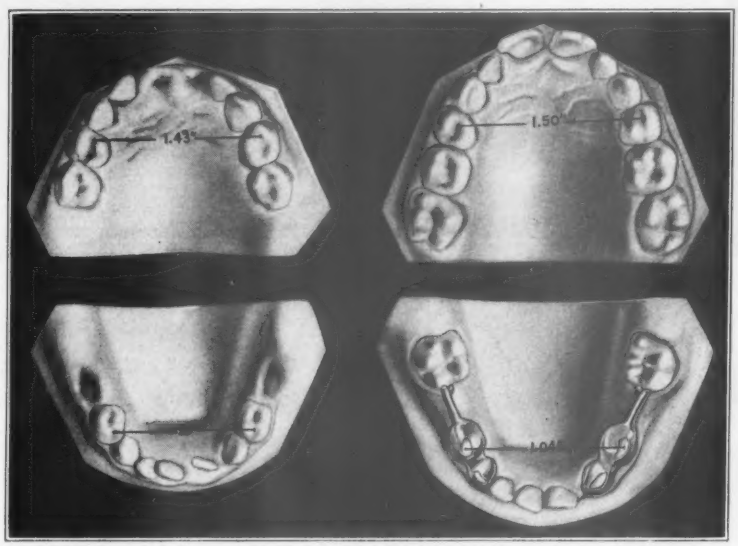

Fig. 14.—Increase in width of dental arches (approximately 0.07 inch) during first ten months after restoration of function. Left, casts taken at 5 years 6 months; right, casts taken at 6 years 4 months.

guided the first permanent molars into fairly normal position.

After eruption of the first permanent molars, the semifixed bar type of functional space maintainers replaced the type first used to control the erupting molars. During the succeeding changes from deciduous to permanent dentition, special attention was given at all times to maintenance of balanced buccal function. carried auxiliary wires so adjusted that, in function, they occluded with the buccal teeth of the maxillary arch. With the partial eruption of the bicuspid teeth, the buccal auxiliary wires were cut off. The lingual base wire remained in place until the bicuspids of both arches were fully erupted and occluded in function. The prolonged use of the lingual support was considered necessary as a precaution

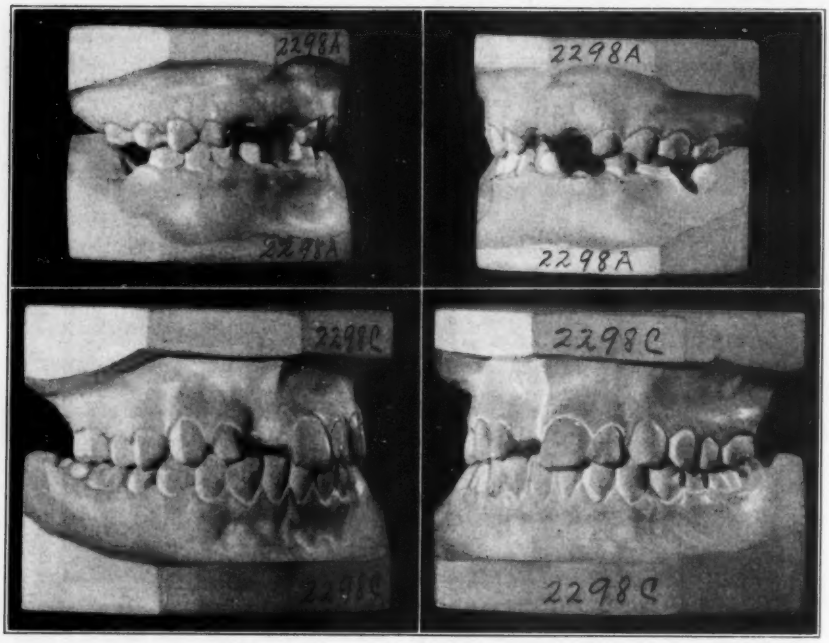

Fig. 15.—Above, condition of denture at 5 years 6 months. Below, occlusion of teeth at 11 years.

When the roots of the mandibular deciduous cuspids absorbed and those teeth became unstable for space maintainer support, a lingual base wire of 0.045 inch was anchored to cast overlays on the first permanent molars. The base wire rested upon the lingual surfaces of the permanent incisors and, in the bicuspid areas, against collapse of the arch, which might have occurred as a result of development of the second permanent molars.

Figure 15 shows the functional occlusion established in this case at the age of 11 years.

Owing to an accident that occurred during the ninth year, the maxillary right

central incisor was lost. Collapse of space was prevented by the use of a retention plate supplied with an artificial tooth.

Considering the condition of the child's teeth at the age of 5½ years, it seems justifiable to assume that, through the elimination of dental foci and the maintenance of a balanced functioning of the buccal teeth, an impending oral deformity was intercepted, and, by interception, prevented.

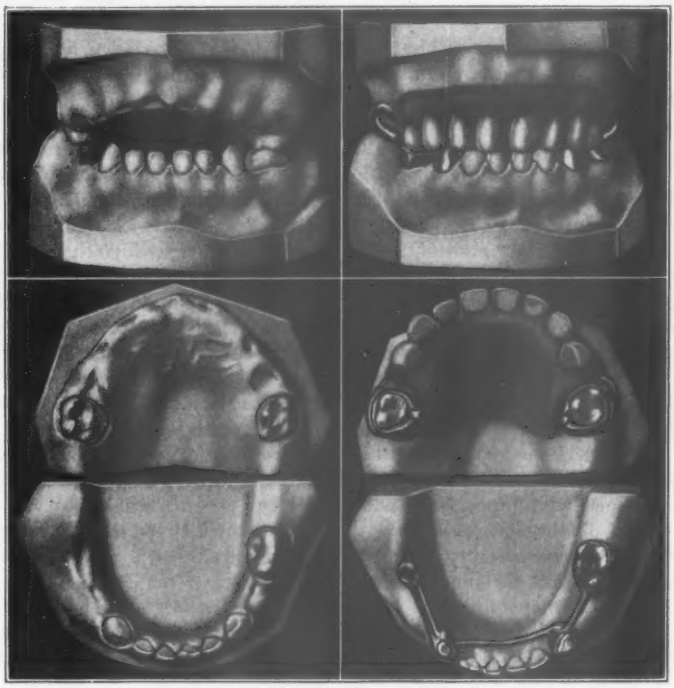

Fig. 16.—Case that required both fixed and removable appliances for restoration of function.

MULTIPLE LOSS OF DECIDUOUS TEETH

Through observation of a number of children who suffered the loss of the mandibular deciduous molars and wore partial dentures between the age of 3 years and the time of eruption of the first permanent molars, it was discovered that, when the partial dentures were discarded and functional space maintainers were installed, immediate growth took place in the cuspid region. Finding that the temporary constriction on width growth was not a serious matter, cases of the same type as those in which the lower partial dentures had been successfully used were experimented on in another way.

Overlays, with heavy cast posterior extensions that occluded with the maxillary deciduous molars, were made for the deciduous cuspids. The distal ends of the extensions were finely pointed and dipped down to contact with the mesioproximal

surfaces of the unerupted first permanent molars. For the purpose of stabilization, the cuspids were connected on the lingual aspect with a clasp metal wire, size 0.064 inch.

The point of interest in this case is the long extension on the right side of the lower space maintainer. The upper partial denture and the lower one-piece space maintainer function together very well. The flattened knob on the cast extension occludes in function with the occlusal surface of the maxillary right second deciduous molar. (Fig. 16.)

While in place, such a device restricts growth in the cuspid region just as the partial denture does, and the appliance must be replaced with a semifixed bar functional space maintainer as soon as the first permanent molar erupts sufficiently to serve as an anchorage. This is because (chronologically stated) the active period of intercuspid dental arch growth takes place between the sixth and ninth years.

It is now our conviction that, in most cases involving a unilateral loss of two deciduous molars or a bilateral loss of three or four deciduous molars in either the upper or lower arch, the one-piece space maintainer, when properly occluded and cemented on the anchor teeth, will prove much more satisfactory than the partial dentures until the time of eruption of the first permanent molars.

CONCLUSION

The scope of this technic, which was devised to more effectively meet the needs of the childhood dental problem in the prevention and interception of malocclusion, has by no means been fully presented here. A greater variety of devices could be shown, and examples of their application in practice given.

During the demonstrations before many dentists and orthodontists of the beneficial results accruing from the use of different types of functional space maintaining devices that have here been shown, the question has frequently been asked, "On whom rests the responsibility for their application in practice?" Until a definite answer is given, and the answer definitely accepted by the general practitioner of dentistry, the neglect of this all-important work will continue to cause a wide gap in oral health service, because of which untold thousands of children, receiving from the orthodontist a meager service compared with that which might have been given, will go through life dental cripples.

Meanwhile, in an effort to bridge this gap, the dentist who preserves the deciduous teeth to the limit of their complete functional use is aiding the enforcement of a great biologic law. The situation affords a golden opportunity for the family dentist to contribute toward the payment to Nature of the debt incurred by man's reckless use of her resources; a debt handed down at compound interest to his descendants.

The fact of the child's helplessness in the whole matter should make a strong appeal to those who are in a position to render this necessary service in time to conserve his health and his outward appearance; on which two things will depend much of his ability to take care of himself through life.

535 Jefferson Building.

CONSIDERATION OF SOME OF THE ETIOLOGIC FACTORS IN TIC DOULOUREUX*

By DON J. AUBERTINE, D.D.S., San Francisco, Calif.

SOME months ago, in a southern city, rummaging in an old book store, I chanced to wander down to a rather dilapidated old bookcase having unusually heavy glass doors, the like of which are seldom seen these days, having long ago given way to more modern equipment. A perpendicular rod ran through islets fastened to the top and bottom of the case and a long rod extended lengthwise from islet to islet and this was fastened by a substantial-looking lock.

My curiosity being aroused, and knowing there must be some good reason for guarding the volumes contained therein, I peered rather closely in an effort to determine the character of these literary treasures. I soon ascertained that they were a collection of old medical books. Noting my interest, an elderly clerk approached and volunteered to open the case and show me some of these guarded works, which he did with great deliberation and ceremony, permitting me to examine several of the volumes.

Immediately my attention was focused on those books that dealt with the epidemic of the late eighteenth and early nineteenth centuries in the Mississippi Valley, and also on those touching on the early history of medicine. Casual reading of a few of these whetted my desire to read further and I therefore spent several hours as the guest of this old book seller, reading chapters on a bygone medical period. One in particular I remember well. It dealt with the epidemic of yellow fever in the Mississippi Basin, which was prevalent during the greater part of the eighteenth century, and I was amazed, on reading this book, at the number of views held as to the cause and cure of that dread disease.

In retrospect of what we know of the disease itself today, its treatment and the methods now used to stamp out, eradicate and prevent the spread of the disease, as compared with the methods used in those days, I was given to an endeavor to draw some corollary between this particular disease and many others that have been conquered only by a long, tedious battle and treatment of which was based upon seemingly childlike theories.

I recalled reading the works of Erhlich, Koch, Leibig and Pasteur, and I could sense in these books the same bitter struggle against many disappointments and frustrations in battling on the frontiers of the unknown.

But what a debt we owe to these early pioneers who worked long and diligently, battling with very mediocre equipage! Reflecting on these early studies as they are described in books, I could not but feel that the ultimate goal when achieved offered far less than the knowledge gathered along the various pathways that finally led to conquest. A consideration of all the factors in a disease process leads to a better understanding of the disease

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 15, 1936.

itself and directs our attention to conditions and influences that, on only a superficial examination, would appear to have only a remote connection. Thus, for example, Bloodgood pointed out that cancer is often associated with and influenced by the presence of syphilis, and that diagnosis and subsequent treatment of one with a disregard for the other will not benefit the patient greatly. Similarly are we concerned with those agencies that lead to an ideal condition for the breeding of a disease, such as undrained areas in relation to the spread of malaria.

In consideration of some of the etiologic factors in tic douloureux, the importance of the foregoing must be stressed, as today we know little about the causes of this distressing condition. First, it would be well to designate, if possible, the symptoms of tic douloureux and to bring order, to some extent, out of the confusion that exists relative to tic major and tic minor.

In our experience, frequently cases have been diagnosed as major tic when, in reality, they were nothing more than minor neuralgias and the etiologic factors were easily ascertained. For practical purposes, we therefore designate the varieties of tics as (1) primary, the causes of which are not known, and (2) secondary, the causes of which are definitely established. This parallels a classification given to anemia, namely, primary and secondary anemia, and also recognizes the fact that this classification considers, in the first instance, an anemia the causes of which are not known and, secondarily, an anemia the causes of which are known.

Again, we must remind ourselves that the etiologic factors in the two classifications may exist coincidentally, and, in some instances, the symptoms of one may be a diagnostic guide for the other. Extensive study and research have revealed that in cases of true major or primary tic, the disease persists even after removal of all suspected and abnormal influences.

The consideration of pain in major tic is of some importance, as, in true cases, these symptoms are very definite, having been adequately described in other works. The presence of trigger areas and the extreme lancinating pain that accompanies this disease require no elaboration here. Determining the location of the exact point of origin is quite difficult. The reflex character of certain paroxysms gives rise to painful sensations in parts remote from the site of disease and may lead a practitioner into a field where there is no pathologic process.

Again, consideration of the nerve tissue itself is of some importance. We are dealing with a highly specialized connective tissue transmitting impulses over an elaborate interconnecting cellular system. Nerve tissue can withstand considerable abuse and its recuperative power is indeed remarkable. Over a long period of time, the accumulated nerve abuses in the form of irritating trauma or infections and fatigue gradually lower the level of resistance to the point that degeneration sets in, chronic neuralgia resulting.

Pain has been looked on as a symptom of a disorder, but the varying degrees of pain and the conditions surrounding the onset of pain have not been given the consideration that they deserve. Thus, dull pain, lancinating pain, chronic pain and the pain of mental anguish, etc., have their particular significance.

Silverman[1] classifies pain in two groups: acute and chronic. He says:

> The acute type is generally characterized by a violent reaction to the sensitive nervous apparatus. The chronic type is the lengthened reaction of the tissues to a constant irritant. Pain may be described as

1. Silverman Max: D. Cosmos, 77:1211 (Dec.) 1935.

continuous, periodic, recurrent, alternating or lancinating, all of which signifies intensity or duration. Pain is not necessarily an indication of an inflammatory state, nor is swelling or redness, for one or all may exist without local inflammation.

He describes tic douloureux in its true form as "a chronic facial neuralgia."

Theodor Blum,[2] in quoting Marshall's classification of neuralgia, states that the pain is dependent on neuralgia or other structural changes in the nervous tissue or cheek and that this chronic neuralgia is only a symptom of a morbid entity.

The consideration of major and minor tic by dentists offers another reason for closer cooperation with the medical profession. As the pain seems to be in association with the dental structures, the dentist is usually the first to see these patients. Usually, they come in at a time when the pain is in an acute stage or the paroxysms are so severe or frequent that relief is sought.

It is not the purpose of this paper to cover in detail the entire possibilities of the etiologic factors in tic douloureux, but to give, if possible, a résumé of some of the characteristics of neuralgia, with some personal observations. Certainly, this field not only offers the opportunity for closer physician-dentist contact, but also indicates again the necessity for early diagnosis in the treatment of all abnormalities, both dental and medical.

Glaser[3] makes the statement that few cases of major tic yield to the extraction of teeth, operations on the nasal sinuses, intercranial section of the fifth cranial nerve or even abdominal operation. It is the observation of some operators that the elimination of dental abnormalities or those disease processes falling within the dental realm has failed to effect a cure. If we keep in mind the fact, above referred to, that the nerve tissue is capable of withstanding considerable trauma and irritation, and we realize the presence of so many of these abnormal conditions in relation to facial neuralgia, their importance cannot be overlooked in the consideration of either major or minor tics. In other portions of the body, the nerve tracts receiving pain impulses and pressure are left with a form of neuritis, and attention is directed toward these abnormalities. Observations directed toward the presence of one of the most common abnormal conditions has led to studies that had for their purpose registration of the degeneration taking place in the nerve tissues not only at the site of contact but also along the tract of the nerve itself.

The dental profession has been too prone to allow the impacted third molar to remain if the patient is not complaining of any untoward symptoms at the time.

Following are some of the conditions, universally regarded as abnormal, that are worthy of consideration in the treatment of major or minor tic. Far *more* important from a dental and medical standpoint is the early recognition of these abnormalities and their correction: impaction of teeth; the presence of pulp stones; the presence of imbedded foreign bodies, such as broken fillings; pulpitis; osteitis; infections; periapical abscesses; sinusitis; poor postoperative results from faulty surgical procedure and ununited fracture.

All of these, in greater or less degree, have some effect on the nerve tissue, and the continued abuse of the nerve fibers gradually leads to degeneration.

The most frequently impacted tooth is the third molar, and if the average

2. Blum, Theodor: Therap. Gaz., July 15, 1911.

3. Glaser, M. A.: Facial Neuralgias in Relation to Dentistry, J.A.D.A., 19:1537 (Sept.) 1932.

practitioner would regard the position of this tooth in relation to the nerve tracts, particularly in the mandible, it would be comparatively easy for him to discover an area of extreme pressure, which is manifested very often by root calcification, hypercementosis and an impingement on the mandibular branch of the fifth nerve at that point.

Shearer, of Omaha, some years ago, called attention to the fact that this condition can be readily determined in adolescence and it is possible to know whether teeth will erupt normally. If it has been definitely decided that it would be impossible for these teeth to erupt normally in the arch, it is better to remove them at this time, rather than later on in life when the roots are fully formed.

Similarly, impaction of the cuspids, which is often seen, can be diagnosed sufficiently early that the orthodontist can bring them into normal occlusion prior to the time when they may cause any injury to the nerve structures at their apical region.

The presence of pulp stones and pulp calcification has caused considerable speculation, and attention has been directed toward them as the possible cause of nerve irritation. In a number of cases, the presence of pulp stones has been the cause of minor tic and the removal of the teeth affected has given the patient relief.

In my practice, certain of these teeth the presence of which causes facial neuralgia have been cut into after extraction and their pulp canals examined. In some instances, a growth of the concretion has been sufficient to cause chronic pulpal degeneration. The presence of broken fillings that find their way into the open sockets after the extraction of teeth is a frequent cause of pain. Quite often, there is a healing over of these imbedded broken fillings and the practitioner is at a loss to account for the severe postoperative pain. Roentgen-ray examination reveals the presence of these foreign bodies.

A very important consideration enters the picture relative to neuralgia, and that is the preparation of the arches to receive dentures. Faulty extraction with poor process trimming that does not take into consideration the proper healing of tissue is frequently a cause of neuralgia. The many fine nerve filaments that enter into the cicatrical tissue will, if not properly protected, receive impulses from pressure on the dentures, considerable injury to the main nerve tract resulting. Chronic pulpitis leads to severe degeneration, and where there is a prolonged trauma, leading to pulpitis in several teeth, there will be definite symptoms of facial neuralgia.

The hypercementosis present around certain teeth is capable of giving rise to nerve lesions. The excess of cementum is sufficient, in some instances, to cause destruction of the peridental membrane itself and will involve the nerves at the apices of the teeth. A condition which aggravates pulpitis, and which is often overlooked, is the grinding of teeth at night. This traumatic influence, if exerted over a sufficient length of time, leads to changes in the pulp which, transmitted over the nerve tracts, are capable of producing symptoms of tic.

Recently, I have dissected out the nerve structure postmortem in those cases that gave a history of tic. Eight such cases have been definitely established as having major tic, and in four the history seems to indicate minor tic. In all cases, there were impacted teeth; in one, there was an ununited fracture, and in two, there were many pulp stones in the molar teeth. All exhibited varying states of nerve degeneration. In those cases classified as major tic, the fifth nerve was well degenerated.

In a consideration of the types of neuralgia, we must not overlook the fact that nerve reflex disturbances are a factor. Suffice it to say here that it must be considered in these cases of tic as a sympathetic neuralgia, since frequently the pain may be felt in an area practically free from disease.

We have all had cases in which a patient with a toothache ascribes pain to teeth that are not affected. This reflex pain manifestation is well known and while, in the field of medicine, it is constantly kept in mind, the dentist is prone to overlook its importance.

CONCLUSION

In the consideration of all these nerve lesions, it is of the utmost importance that a detailed and systematic diagnosis be made and that we direct our attention particularly to the presence of impacted or malposed teeth, the results of improper surgical procedure in the extraction of teeth and preparation of arches for dentures, and chronic infections.

AN ANALYTIC STUDY OF MODERN ABUTMENTS*

By ARTHUR O. KLAFFENBACH, D.D.S., F.A.C.D., Iowa City, Iowa

IN a recent report of the Curriculum Survey Committee of the American Association of Dental Schools,[1] "dental prosthesis" is defined as "the science and art of providing suitable substitutes for the coronal portions of teeth, or for one or more lost natural teeth and their associate parts, in order that impaired function, the esthetic appearance, comfort, and health of the patient may be restored."

This broadening scope of restorative dentistry further accentuates the fact that health is the firm foundation upon which modern dentistry should be based. An appreciation of this fact, together with concentrated attention on the interrelation of dental and general health has lead to a fuller realization of the biologic basis for dentistry. The importance of this biologic concept has been expressed in the statement by William J. Gies[2] that, "an oral or dental appliance or procedure that violates physiological principles or disregards biological conditions, even though it be mechanically and esthetically perfect, may be tragic in its consequences of distress, disability, or disease."

From this, it is evident that the restoration of edentulous spaces, by means of fixed partial denture prosthesis, in order to be a health service to the patient, demands a reconstruction of our ideas of mechanics in their relation and application to physiologic laws. The very fact that many of our operations for abutments are performed on living tissues that directly involve the health of the

*Read before the Section on Partial Denture Prosthesis at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 15, 1936.

1. Course of Study in Dentistry, Report of the Curriculum Survey Committee, American Association of Dental Schools, p. 269.

2. Gies, W. J.: Dental Education in the United States and Canada, New York: Carnegie Foundation for the Advancement of Teaching, 1926, p. 129.

patient makes it compulsory that such abutments be so designed and constructed that they will be a substitute for the abutment teeth and maintain them and their investing tissues in a state of health. In other words, the first approach should be that of health, function and service, and the second that of mechanics, craftsmanship and esthetics.

EXAMINATION AND DIAGNOSIS

A thorough and intelligent examination of the mouth and teeth is one of the most essential aids to an accurate diagnosis. Roentgenographic examination of the case is of great importance and roentgenograms of the case should always be obtained prior to arriving at a plan of treatment. We must realize that no diagnosis should be made which is based on roentgenographic examination alone. In every diagnostic study, we should consider, in addition to pathologic and anatomic changes in structure, at least three other factors: the causes of abnormalities, the existing trauma and the distribution of function.

TREATMENT

Unfortunately, the restoration of short span edentulous spaces begins with conditions as they exist; which greatly complicates the treatment. Consequently, the number and position of the teeth to be supplied in relation to number of abutment teeth; the condition of the tissues involved; the occlusion; the size and form of the abutment teeth and roots, and many other conditions influence the operator in his selection of the type and design of the restoration indicated.

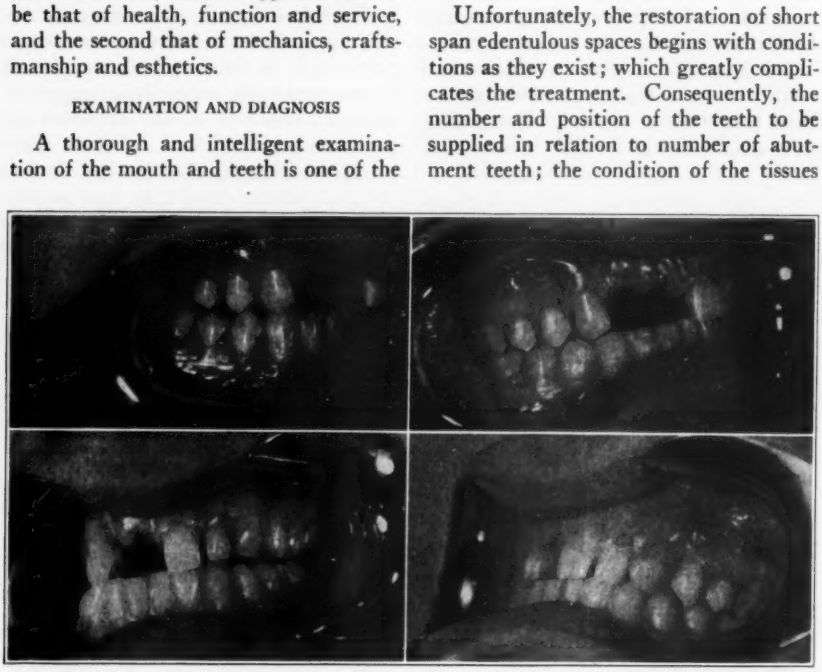

Fig. 1.—Left, condition before occlusal adjustment. Right, condition after occlusal adjustment. The possibilities of eliminating trauma on the cuspids, especially the upper right cuspid, which is to be used as a bridge abutment, is shown, with the general improvement in the occlusion resulting from a slight amount of grinding in this region.

ABUTMENT TEETH

The engineer who plans a bridge first calculates how strong it must be to carry a moderate load. In actual construction,

this calculated strength is increased several times in order to provide an ample margin of safety. As a result, the bridge is able to carry a much heavier load than was originally planned, if it becomes necessary through changed conditions. The additional strength may likewise prove invaluable should any portion of the material prove defective or become defective with age.

In most physiologic processes, a similar margin of safety is provided. Were it not for the fact that Nature has provided

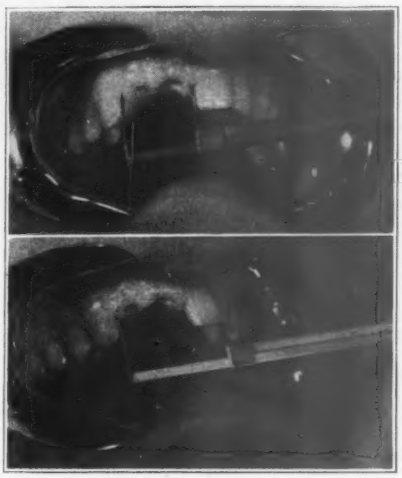

Fig. 2.—Paralleling proximal grooves for three-quarter crown preparations using parallelometer for accuracy.

teeth with a wide margin of safety and increased functional capabilities, abutment teeth could not withstand, within reasonable limits, the additional stress and additional load placed upon them by the attached pontics. In the plan of treatment, care must be exercised that the demands made on the abutment teeth and their investing tissues do not exceed their functional capacity; for when the mechanical demands exceed the biologic balance, a pathologic condition is sure to result.

PULP CONSERVATION AND HEALTH OF ABUTMENT TEETH

Since the health of the abutment teeth and conservation of the dental pulp are of vast importance, it is necessary to consider them in connection with a study of abutments. No matter how carefully an abutment is designed and constructed, or how perfectly it fits, if it is not in physio-

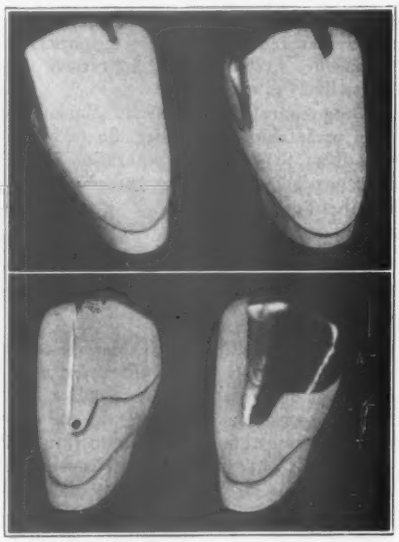

Fig. 3.—Abutment for mesially inclined lower cuspids. Above, labial view. Below, lingual view.

logic and biologic relationship to the pulp, dentin and enamel, its futility as a health and preventive factor is inevitable.

Drs. Bödecker and Applebaum, in their article on "The Variable Permeability of Dentin,[3] arrive at the following conclusions:

3. Bödecker, C. F., and Applebaum, Edmund, D. Cosmos, 75:21 (Jan.) 1933.

Pulps are affected differently by fillings in carious and noncarious teeth.

If the dentin has been previously irritated by decay, it becomes less permeable, hence, a filling will not harm the pulp so easily unless the cavity is extended laterally into more permeable and unaffected dentin.

Noncarious teeth of young individuals, being highly permeable, must be prepared for bridge abutments with the greatest circumspection; otherwise, the pulp will be seriously affected and may cause disagreeable complications.

Noncarious teeth of older individuals prepared for bridge abutments are usually more matured and therefore more impermeable, so that pulpal irritations are not so likely to occur.

The preparation of inlay attachments is done preferably: (a) under the exclusion of saliva; (b) with the generation of the least possible heat; (c) by immediate sealing of cut ends of tubules with a varnish or cement.

Edward H. Hatton[4] further substantiates the importance of this subject as follows:

The susceptibility of the dentin arises from its relatively porous character, penetrated as it is with minute tubules, and from the structural character of the contents of these tubules. The structure and function of the soft tissue extensions of the odontoblasts, Tome's fibers, contained within these tubules, are not only susceptible to the effect of injury, but these structures serve equally well to transmit injuries to the pulp. . . .

Therefore, as soon as the dentin is exposed in any fashion whatever, degenerative changes are set up in these tubular contents, that is, Tome's fibers. This is not only what should be expected, but is also capable of ready demonstration by histologic and experimental methods. Even diffusible chemicals, if deposited on denuded dentin, are carried not only to the pulp, but even to remote parts of the body as long as the tubules contain soft tissues or retain their porous character.

From such findings as these, one becomes cognizant of the importance of preparing teeth or cavities for abutments in a dry field; designing the abutments in accordance with the size and location of the pulp; providing adequate protection for freshly cut dentin, and avoiding infection, thermal shock, chemical irritation and mechanical injury, or trauma, of the dental pulp.

The use of the rubber dam has long been recognized by gold foil operators as a necessary adjunct for best results. Just why its use has been abandoned by many dentists in preparing vital teeth for abutments is a matter of conjecture. It is perhaps needless to say that all vital teeth used for abutments must be freed from all decay. In order to be certain that this has been accomplished, all existing fillings and crowns, whether good, bad or

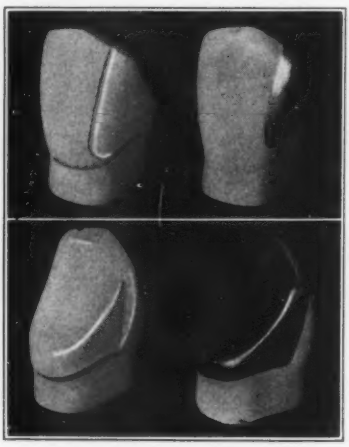

Fig. 4.—Abutment that can be used to advantage when it is desirable to lap a pontic over labial surface of central incisor or cuspid. Above, labial view. Below, lingual view.

4. Hatton, E. H.: Pulp Pathology from Standpoint of Clinician, J.A.D.A., 17:2262 (Dec.) 1930.

indifferent, must be removed, nothing but healthy tooth tissue remaining. Then, with the rubber dam still in place, the dentin should be sterilized and proper pulp protection and a cement lining, or varnish, provided. All carious dentin must be removed even though the pulp is thus exposed. Wherever caries has progressed to such an extent that the pulp is exposed in its removal, there is little doubt as to pulp involvement necessitating its extirpation or the extraction of the tooth.

CONDITIONS FAVORABLE AND UNFAVORABLE TO FIXED PARTIAL DENTURE ABUTMENT TEETH

Conditions of	Favorable	Unfavorable
Apical areas	Normal physiologic tone	Pathologic
Investing tissues	Normal	Pathologic Recession
Osseous structure	Normal Normal mineralization	Resorption Demineralization Pathologic
Alveolar support	Adequate	Inadequate
Pulp	Vital, normal Protected with healthy dentin Normal recession	Nonvital Devitalized Pathologic Exposed
Calcification	Complete	Incomplete
Dentin	Normal	Hypersensitive Infected
Crowns	Average length Normal size Normal form	Short, malformed Tapering Extensive caries Extensive fillings
Roots	Longer than crowns Typically shaped	Short, fused Malformed Tipped Thin
Occlusion	Functional	Traumatic Malocclusion
Bite	Normal	Abnormal
Vertical alinement	Parallel Normal position	Tipped Malposition Lapped Rotated

STERILIZATION AND PROTECTION

When all decay has been removed, the dentin may be treated with 95 per cent phenol followed by 70 per cent alcohol; or when a less irritating drug is desired,

acriflavine may be used. The surface of the dentin is then coated with cavity varnish, care being taken to keep it off the margins or periphery in preparation. The varnish seals the surface of the dentin, and serves as a protective medium during the time when the wax pattern is taken, when the impression is obtained and while the temporary filling is being worn.

In extensively decayed posterior teeth without pulp exposure, after the removal of all carious dentin, ammonical silver nitrate reduced with an essential oil such as eugenol affords an efficient means of sterilization. Because of discoloration, this treatment is best adapted to posterior teeth, especially those requiring crown restoration.

After the ammoniacal silver treatment, the nonconducting layer over the pulp is increased with a coating of good cavity lining or varnish, after which a thick paste consisting of eugenol and thymolized calcium or uncalcined zinc oxide free from arsenic is applied. The remaining portion is then filled with a carefully mixed copper or oxyphosphate cement, which is utilized as a base or a part of the cavity or tooth preparation for the abutment.

CHEMICAL IRRITATION

Chemical irritation of the cytoplasm in the dentinal tubules may be caused by the presence of free acid in the cement mix. To avoid this, a small portion of cement powder should first be mixed with all of the liquid, after which small portions of powder should be added and mixed slowly over a large area of a cool glass slab.

THERMAL SHOCK

Thermal shock, irritation or injury to the pulp may result from heat generated by the careless use of burs or stones, or from the use of cold water, in preparing the abutment tooth. Medium engine speed, intermittent lateral medium pressure and the use of small sharp burs and clean true running, fine or medium grit stones coated with cocoa butter will reduce to a minimum the possibility of hyperemia of the pulp and will also add greatly to the comfort and satisfaction of the patient.

The extent and depth of an abutment cavity should be carefully determined in relation to the pulp, and only sufficient tooth substance should be sacrificed to obtain adequate retention, resistance, strength and outline form. When such precautions are observed, the bulk of gold required for the abutment is materially reduced. Since thermal conductivity of a gold alloy is about 300 times more than that of cement, interposition of a layer of cement between the gold abutment and the dentin is decidedly advantageous in protection against thermal irritation or shock. For the same reason, the relieving of the inside of cast gold crowns, and the cavity side of inlay abutments, in order to increase the thickness of the interposed cement, is recommended.

Care must also be exercised in adjusting the occlusion and in finishing and polishing the prosthesis after it has been cemented to place, in order not to generate undue heat by prolonged grinding or excessive pressure.

OCCLUSION

Disease and destruction of the dentinoalveolar tissues are now so commonly recognized as sequelae of traumatic occlusion that it behooves us to check the occlusion of the abutment teeth carefully and to eliminate such conditions throughout the mouth in order that coordinated occlusion and an equal distribution of stress be established and maintained. The abutment teeth are, in many instances,

in traumatic occlusion in varying degrees; a condition which can readily be relieved by correct grinding of the abutment teeth or the opposing teeth, this depending on the existing trauma during centric occlusion and the excursive movements of the mandible. Preventive treatment, such as this, before the abutments are constructed or the preparations made, adds greatly to the life and function of, and minimizes the stress imposed on, the abutment teeth and the teeth opposing them.

INLAY ABUTMENTS

We all realize that in many cases, failure of fixed bridges is due directly to the use of inlays for abutments. In most instances, it is the result of poor judgment; faulty technic; the use of soft golds or golds that do not have the required physical properties, and a lack of consideration regarding the stresses that will have to be withstood.

Short teeth, small teeth or teeth both short and small should never be used for inlay abutments. In the first place, these small inlay abutments do not afford sufficient resistance against the stresses imposed on them, and, secondly, because of the short cavity surface contact, sufficient frictional retention is not obtainable.

Extensively decayed teeth with thin buccal and lingual walls, inadequately supported with dentin, are poor risks, even though the tooth is of adequate length and size. While the strength of the walls may be great enough to prevent fracture, they frequently yield slightly, the cement fracturing and the inlay loosening as a result.

Because of the buccolingual width of the occlusal surface of the pontic, torsional and other stresses exerted on the pontic act as a lever, which, in many instances, actually pries the inlay out of the abutment tooth.

The "cradle effect" produced by the intermittent stress on the buccal and then on the lingual areas of the pontic, during the process of mastication, results in rocking the inlay loose or out of the cavity. This may, in some instances, be overcome by increasing the buccolingual dimensions of the gingival seat and the addition of a buccal or lingual extension, or both. Because of the anatomic structure of the lower molar teeth, with their sloping buccal surfaces, and the possibilities of decay or recurrence of caries, the lingual surface is generally used on the lower molar teeth; while the buccal extension, or distolingual extension, is preferable on the upper molar teeth.

Lack of thickness or width in the region of the constricted portion of the dovetail on the occlusal surface, or in the region of the pulpo-axial angle, produces an inlay abutment that will yield or bend, the axial surface adjacent to the pontic becoming loosened and opening of or leaking at the gingival margin resulting.

All inlay abutments must be prepared according to Dr. Black's fundamental specifications, with such modifications as further extension for prevention because of the relation of the pontic to the buccal and lingual margins of the inlay. Such extension is easily obtained by slightly increasing the bevel; which can be done without the loss of very much additional dentin.

Retention is also important, and any inlay that lacks sufficient frictional retention places too much responsibility on the cement and is entirely inadequate. Many preparations are too nearly "hopper-shaped" and, because of their tapering walls, lose much in the way of retention, which might have been adequate had the walls been more nearly parallel to each other.

Even though the cavity is properly prepared, many an inlay has failed because the wax pattern was not accurately

adapted to the cavity walls and angles. If care is not exercised in securing an exact counterpart of the cavity, the contacting area is decreased and the corresponding retention is proportionately reduced.

SLICE CAVITY ABUTMENTS

The advantages claimed for the slice cavity preparation over the modified Dr. Black's are as follows:

1. It increases retention. 2. It eliminates need of flaring in order to carry out the requirements of extension for prevention. 3. It saves time. 4. It conserves tooth tissue. 5. Less injury is caused to the enamel in finishing the margins. 6. There is more assurance against recurrence of decay at the gingival aspect. 7. The prepared cavity is a greater distance from the pulp and therefore the chance of injury is lessened.

After a careful study and comparison of these two types of preparations, W. L. Wylie[5] arrived at the following conclusions:

1. The amount of tooth substance saved through the use of the slice preparation gives it a slight preference.

2. Greater extent of margins in the slice preparation lends to greater ability of mechanical imperfection in this vulnerable part of the restoration and increases the possibility of recurrence of decay.

3. There is nothing in the observation made to support the contention of some that the approach towards the pulp is less in the case of the slice preparation than when the box type is used. On the contrary, if the surface to be restored is markedly convex, the approach must be much closer.

My clinical observation has been that the thin marginal periphery of the wax pattern is easily distorted and that these feather edge margins of the finished casting are easily overground during the polishing process, exposed or scolloped margins resulting.

Because of the thinness of the outer walls of the "T" locked type, these walls are easily fractured during the fitting of the abutment or seating of the completed prosthesis. Furthermore, this type cannot be used where the axial wall has been destroyed by caries.

ANTERIOR THREE-QUARTER CROWN ABUTMENTS

Because the anterior three-quarter crown has been used universally for bridge restorations without taking into consideration the anatomic structure of the tooth, its condition or alinement has resulted in many unnecessary failures and caused much unjust condemnation. When properly applied and accurately constructed, it affords the best type of abutment available at the present time for most vital anterior teeth. Its satisfactory application depends primarily on the selection and use of only such teeth as are adapted to this type of abutment and an exacting cavity preparation, so prepared that its triangular grooves are parallel with each other and those of the other abutments. The grooves must be so shaped that they will provide ample retention, resistance to stress and a closely adapted and correctly contoured wax pattern, which must be accurately reproduced in a casting of gold alloy possessing the physical properties to meet the demands of the case.

Teeth of the square type are best adapted to the application of the anterior three-quarter crown; while the tapering type is not so favorable, and, in some instances, not at all acceptable. It is contraindicated on extensively decayed teeth where retention and grooves cannot be made in dentin; on short teeth; on teeth

5. Wylie, W. L.: Comparative Study of Slice and Box Preparations, J.A.D.A., 21:1391 (Aug.) 1934.

which taper toward the incisal edge, with little or no possibility of paralleling the proximal surfaces for retention, such as are frequently seen on cuspid teeth, and where the bite is so close that a sufficient thickness of gold for stability cannot be had on the lingual surface to prevent bending or spreading of the axial surface due to weakness of the casting, causing it to function similarly to a clasp.

Parallelism of the preparation groove surfaces with the other abutments is another absolute essential if distorted margins are to be avoided and the case properly seated. Lack of parallelism can only result in a strained relation of the abutment teeth, and ultimately the cement will fracture and the abutment loosen. The use of a parallelometer of some sort is strongly recommended, as the eye is not dependable. The inaccuracy of the eyes can very readily be determined by checking the grooves, or prepared surfaces, with an instrument of this kind. The errors of the eye, no doubt, are due to a lack of training; optical illusions due to the various curved and slanting surfaces and lines encountered, and retinal fatigue.

The incisal groove, which is frequently omitted, has, in many instances, a definite function in developing a staple-shaped reinforcement when connected with the proximal grooves. Sometimes, this groove can be dispensed with, provided a type "C" gold alloy possessing adequate strength is used. Where required, additional retention may be secured by placing a 20-gage iridioplatinum pin in the cingulum.

The bluish gray discoloration sometimes seen along the labioincisal third may be attributed to the shallowness of the labial plate of enamel. This condition often results because the incisal groove necessitated the removal of dentin in this area, or from the thinness of the tooth. It may also be caused from failure to remove the gelatinous placque or to clean the prepared areas thoroughly before cementing the abutment; use of certain sterilizing agents, or failure to remove the oxide or dark discoloration on the cavity side of the three-quarter crown casting. Care must also be exercised to remove all traces of acid or soda used in the pickling process.

The gingival outline should be a finishing line and not a shoulder. This finishing line, when properly made, provides a definite place for terminating the wax pattern, or at which the gingival periphery of the three-quarter crown is finished.

PINLEDGE ANTERIOR ABUTMENT

The pinledge anterior abutment utilizes pins as the chief means of retention. In order to obtain the highest efficiency from pin retention, it is imperative that the pin fit the hole accurately. When six pins and pin holes are involved on two abutments of different inclinations, the paralleling of each individual group of pins used in the one abutment with those of the other requires a precise and accurate technic.

The proximal triangular grooves of the three-quarter crown have a decided advantage over parallel grooves or pin retention. The grooves, being wider labiolingually at the incisal edge than at their gingival termination, provide a slight amount of movement labiolingually when the abutment is started to place. Frictional resistance begins as soon as the gingival ends of the cast abutment enter the preparation.

The fact that the pin holes are often placed in close proximity to the pulp and a depth of at least 1 mm. must be had to provide ample retention increases the possibilities of pulp irritation or of undetected caries advancing more rapidly toward and involving the pulp.

POSTERIOR THREE-QUARTER CROWN ABUTMENTS

The posterior three-quarter crown abutment also requires a careful selection of abutment teeth. Its range of application is very limited, being confined to teeth of average length or longer, where proximal grooves of sufficient length may be obtained. Insufficient retention results from having mesial and distal grooves that diverge too much; short distal surfaces, frequently found on molar teeth; and flat occlusal surfaces, preventing the preparation of an occlusal groove of sufficient depth. Because of inaccessibility, the use of the distal gingival area, especially of the second molar tooth, is quite frequently contraindicated. Since the grooves must be placed in dentin, teeth with extensive caries are not adapted to this type of abutment.

On the upper posterior teeth, the lingual surface is included as the third surface; while, on the lower, the buccal is utilized as the third surface. Under certain conditions, it may not be advisable to extend the outline form under the free margin of the gum, but to terminate it just gingivally from the height of convexity on the buccal or lingual surface, or on both surfaces.

The lower first bicuspid is the most difficult tooth for which to make a satisfactory abutment, from both a retentive and an esthetic standpoint. The three-quarter crown usually involves the entire lingual and a portion of the buccal surface. Esthetically, this is objectionable because of the prominence of the occlusal third of the buccal surface of this tooth, which makes the abutment appear like a gold crown.

This extension of the buccal surface is necessary to prevent dislodgment in a lingual direction because of the shortness of the lingual cusp and the relatively small frictional wall retention obtainable if the crown were seated on the linguo-proximal surfaces only.

PARTIAL VENEER CROWN ABUTMENTS

Many of the so-called partial veneer crowns, or half-crowns, are merely modifications of the three-quarter crown. Some of them are entirely too complicated; others entirely inadequate to meet the demands of a fixed bridge abutment; and some of them have such extensive margins that they should not be used in mouths where susceptibility to caries is evident.

The proximal veneer crown with grooves on the buccal and lingual instead of the mesial and distal surfaces can frequently be used to advantage. Where it is not advisable to extend the cavity into the distal aspect of a molar tooth or the tooth is tipped, these grooves may be so placed that the abutment will shed in a direction parallel with the abutment anterior to it. The mesial cusps may also be restored to the existing occlusal plane and functional occlusion in restoration of the mesial cusps involved in the abutment.

CAST GOLD CROWN ABUTMENTS

Unfortunately, while the full cast gold crown abutment fulfils all the mechanical requirements, esthetically it is highly objectionable. For maximum retention and for badly broken down, badly decayed and short teeth, it is the desirable abutment for posterior teeth. In many instances, the preparation of the natural tooth does not require so much loss of tooth structure as some of the more extensive inlay or three-quarter crown preparations. It does not impinge on the gingival tissues because of its finishing line construction; nor is it necessary to lacerate the gingiva as was almost always the case when the preparation for a shell crown, which necessitated the removal of

the gingival enamel to the cemento-enamel junction, was made. The occlusion and tooth form can be accurately reproduced, the only limitations being the operator's ability to manipulate and carve wax and his knowledge of dental anatomy and the physiologic and biologic requirements. With a gold alloy with known physical properties, thin cast crowns of adequate strength can be readily obtained. Improved expansion casting technic has made it possible to obtain the required amount of expansion so that an accurate fit of the crown is assured.

On bell-shaped teeth, the buccal and lingual margins need only extend about 1 mm. beyond the greatest convexity of the tooth. When this is done, care must be exercised that the margins are extended and terminate in immune areas, and also that the preparation is not made too conical so that the finished crown will have adequate retention and a minimum amount of gold.

BROKEN-STRESS OR MOVABLE JOINT ABUTMENTS

The so-called broken-stress abutment with an occlusal rest or interlocking lug provides a means whereby tipped teeth, which could not be paralleled without too much tooth destruction, can be utilized by developing a lug seat in the supporting abutment parallel with the line of placement of the retaining abutment. While primarily the purpose of this type of construction was to provide movement of the abutment teeth comparable to that of the individual tooth, there is danger of this type of abutment, if not properly constructed, permitting too much movement of the retaining abutment tooth.

OCCLUSAL REST ABUTMENTS

The occlusal rest type does not afford any resistance against drifting unless it is dovetailed in form; nor does it limit movement occlusally. When used in an upper restoration, it has a tendency to permit the pontic to drop slightly so that the lug is not in contact with its seat, too much movement in and out of the lug seat resulting. On the lower cases, the tongue quite frequently plays on the linguogingival area of the pontic, exerting an upward pressure which lifts the lug out of the lug seat and also moves the retaining abutment tooth. Not offering any vertical resistance, sticky foods or candy also have a tendency to dislodge or pull the pontic and lug occlusally.

PIN AND SOCKET ABUTMENT

While the pin and socket abutment has some advantages over the occlusal rest, drifting apart of the abutment teeth is permitted, especially if the posterior abutment is the last tooth in the arch. This drifting may be prevented to a limited degree by constructing the pin so that it will have a slight gingival inclination and thus the forces of mastication will tend to hold the abutment teeth in correct relationship.

MORTISE LUG ABUTMENT

The mortise lug abutment, because of its retentive form, provides the much desired restricted movements and prevents drifting. The supporting inlay or abutment must have sufficient proximal surface and thickness that a lug seat of adequate size can be prepared in it. The line of placement must be carefully noted and the lug seat so prepared that the completed bridge can be readily seated without undue pressure or strain on the abutment teeth.

When it is desirable to further restrict the movement of the lug, the occlusal edge of the lug may be ground slightly and the edge of the lug seat clinched over this area.

BAKED PORCELAIN ABUTMENTS

While porcelain bridge restorations are very limited in their application, the subject of abutments would not be complete without a brief discussion of some of them. Esthetically, porcelain abutments are far more desirable than any other type. Porcelain, being friable, is subject to breakage and, when fractured or broken, cannot be repaired. Patients must be carefully selected as regards the occlusion and the strength of the bite. The age of the patient in relation to the size of the pulp and extent of calcification is always an important factor. The use of normal teeth free from caries is a questionable procedure and not generally advisable because of the loss of tooth structure necessitated to provide for sufficient thickness of porcelain. In most cases, the use of porcelain abutments should be confined to teeth that are carious, disfigured by extensive gold restorations or discolored; in which hypoplasia is prevalent, and in which the bite is favorable.

PORCELAIN JACKET CROWN ABUTMENT

Since all porcelain jacket crowns are subjected to breakage, it is reasonable to expect that when they are used as an abutment, the possibilities of breakage are greatly increased. While this type of restoration is advocated by some, its range of application is very limited and its life period an uncertainty; which precludes its use in most cases.

THIMBLE JACKET CROWN

The thimble jacket crown abutment is so designed that the porcelain jacket crown with a v-shaped opening on the proximal surface adjacent to the edentulous space fits over a thin hard gold thimble or core, with a lug for attaching the pontic with solder. In case of breakage, the porcelain jacket crown can be replaced without removal of the entire bridge.

The success of this type of abutment is dependent on the selection of cases with sufficient pulp recession to permit ample reduction of the tooth for a thin, hard gold alloy core and a porcelain jacket crown of adequate thickness to withstand the stresses of mastication.

REINFORCED BAKED PORCELAIN ABUTMENTS

The porcelain bridge with a metal structural reinforcement on which porcelain is baked is not new, but recent developments in metallurgy and ceramics have greatly increased its possibilities. Such reinforcement may be constructed of platinum and iridioplatinum, with platinum solder or paladium for uniting the metal framework. After the framework is completed, it is coated with a layer of opaque porcelain and completed with dental porcelain.

The construction of these reinforcements could be greatly simplified and improved if they could be made in wax and then cast in one piece or in integral parts and the various parts then assembled. This, of course, would require a special high-fusing alloy with the correct coefficient of expansion and contraction, so that porcelain could be applied satisfactorily. Such an alloy is not beyond the realms of metallurgy; and, with the cooperation of the ceramist and metallurgist, such a high-fusing alloy may be available in the near future.

There are many other vital phases of this subject that might be discussed in detail but time does not permit. In closing, may I say that what I want to leave with you is not what my opinion is regarding this subject—that is quite unimportant. My objective has been to impress upon you the vital importance of the many details involved, and the neces-

sity of searching aggressively with open mind for the fundamental truths in the broader relationship of dental prosthesis to society; the separation of truth from fallacies; and the promotion of restorative dentistry to such an extent that it will be a health and preventive service in every sense of the word.

IMPORTANCE OF MOUTH BRUSHING*

By FREDERICK A. BRICKER, D.D.S., F.A.C.D., Los Angeles, Calif.

I HAVE been discussing the subject of mouth brushing for the past eighteen years. We have continued to discuss this time-worn subject because we still fall short of getting the desired results. Where does the fault lie—with the dentist or the patient? I believe that, in justice, the blame should be divided: we dentists do not always put the case as clearly and vividly as we should; and the patients are, after all, human beings, given to more or less spasmodic cooperation.

At the outset, let me say that I do not believe mouth brushing to be the all-important factor in preventing mouth disease. There are many other factors in such disease, even in a clean mouth; but an unclean oral condition is an extremely important contributing factor—the more important because it is so difficult to impress on the patient the idea of thoroughness, to show him the difference between thoroughness and frequency of motion when it comes to the use of the toothbrush.

We are living such a strenuous life, with so many distractions, that many persons find twenty-four hours too short to meet the daily demands made on them. As a result, they are prone to neglect themselves—to steal a minute here and there from just such things as brushing the mouth for some other demand which at the moment seems more important. Later they find, to their chagrin, that this minute-stealing has been very costly. Twenty years ago, the president of a famous Eastern college said that any well-bred girl took an hour to dress in the morning. I believe that in this "well-bred" time budget she must have allowed ten minutes for thoroughly cleaning the mouth. But how many girls or boys allow that much today? Ten minutes for shower and care of mouth and hair would be nearer to it.

What kind of mental picture can we conjure up that will lead our patients to keep scrupulously clean mouths? Words of admonition alone will never do it.

There is no better school for this particular lesson in dentistry, I believe, than the dental chair, with mirror, models, stain and toothbrush replacing the proverbial blackboard and chalk. Since visual memories predominate in most persons, our word picture should be so vivid that the patient retains a definite mental picture of what occurs during and after proper mouth brushing, and understands why the result is so beneficial.

Full mouth roentgenograms of an advanced case of periodontoclasia speak a

*Read before the Section on Periodontia at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 15, 1936.

potent language. I show such films to every patient who is inclined to neglect the mouth. It is equally desirable to teach each patient to read the roentgenray films, and thus help him to realize his condition, and thereby gain his confidence. When the patient sees his roentgenograms, his interest is aroused and he is ready to begin his lesson, which falls into several parts. If the lesson is well presented, it will be followed by the desired action and, we hope, faithful pursuit of the desired result.

The patient particularly needs to know (1) the causes of decay; (2) the causes of periodontoclasia; (3) the fact that a large percentage of decay and periodontoclasia can be prevented by proper hygiene and diet, and by regular visits to the dentist; (4) that periodontoclasia is not a specific or contagious germ disease; (5) that only the exceptional mouth will stay healthy without care; (6) that the oral cavity is the seat of more focal infection than any other part of the body, and the area available for infection is greater; (7) the fundamentals of diet, as affecting the mouth; (8) how to brush the mouth correctly; which should be demonstrated on the patient, as well as described, and (9) the general habits that are conducive to better health.

Details regarding each of the broad factors are hackneyed; but I shall dwell on some of the more important points.

1. *The Local Causes of Decay and Periodontal Disease.*—These can be effectively brought home to the patient by staining the surfaces of his teeth with a disclosing solution, so that he can see the bacterial plaques in the mirror. His surprise at once leads him to demand explanation, and gives the dentist an excellent opportunity to explain the action of bacterial plaques in forming acids, which disintegrate the enamel and irritate the soft tissues, and how deposits are formed by allowing such plaques to remain on the teeth. The next step is to brush the section stained and show how the plaque can be removed.

2. *The Local Causes of Periodontoclasia.*—The patient is told that periodontoclasia is the breaking down of the tissues around the teeth, and that the principal cause of the condition in younger patients (from 19 to 30) is lack of proper stimulation of the gums and insufficient activity in mastication. Later in life, it is explained, the abnormal occlusal wearing down of the teeth produces traumatic occlusion and periclasia. That loss of teeth and inaccurate, unfinished and unhygienic restorations are also factors in periodontoclasia in the adult is emphasized.

3. *Prevention of Decay and Periodontoclasia.*—The important areas where decay begins: pits, fissures, interproximal surfaces and gum margin, are pointed out and the patient is shown how to apply the brush to these areas. Regular vists to the dentist as a preventive measure should also be stressed.

4. *Cooperation of the Patient.*—It is made plain to the patient that "to cure" means merely to restore to health, not to make immune; and that the permanent result depends on his daily efforts much more than on the occasional efforts of the dentist. He is shown that thoroughness rather than frequency of effort is the vital factor, although one should not minimize frequency. In dealing with men patients, one can bring this point home by drawing a parallel with business: perpetual motion may only cover failure; but thoroughness and sound planning always gets results. Women know that their friends who are everlastingly at their housekeeping are not the best housekeepers: here again, it isn't motion that counts, but how the motions are made. Most patients have become so used to their own particular method of mouth

brushing that it takes some such comparison to dislodge a fixed idea and get them to initiate a more adequate procedure. This is particularly true if they are convinced that they have been thorough, and that they have kept the mouth clean. The staining will show them that they have not succeeded, however earnest their purpose. They should go away from our offices realizing that the question is not only, "How many times a day do you brush your mouth?" but also "How do you brush your mouth?"

5. *The Mouth as a Seat of Infection.*—Many patients realize that the mouth is a seat of infection, but few realize that it is the seat of more infection than any other part of the body. A demonstration of how large an area is available in the mouth for the infective organisms to attack is, therefore, most effective.

6. *Fundamentals of Diet as Affecting Teeth.*—"What has diet to do with teeth!" is so common an exclamation that it is important to explain that the mastication of fibrous foods, such as coarse breads, raw vegetables and fruits, is essential to the maintenance of oral health, since mastication provides a natural massage of both gums and teeth. The influence of acid and alkaline forming foods should be mentioned and the importance of the calcium-phosphorus balance in the food intake.

With most patients, a realization of these truths results in cooperation and intelligent effort. In the rare cases of continued indifference, an inventory of one's manner of presenting the lesson is more profitable than too severe criticism of the patient.

I work on this foundation: that good circulation is the definition of health, where there is normal blood. One of the essential lessons I teach is that of circulation, beginning with a consideration of the general circulatory system and gradually leading up to discussion of the circulation in the mouth. I wish my patient to know that the professional masseur massages from the extremities toward the heart because the arterial blood is under pressure from the heart, which forces it into the tissues, while the venous blood is controlled largely by check valves in the veins, which, forcing the blood toward the lungs, also prevent its return to the tissues. We have been teaching that massage brings arterial blood to the part, when really we are forcing out the venous blood, thus forming a vacuum for the arterial blood to fill. The blood for the teeth and their surrounding structures is carried to the apices of the teeth, and there the arteries are divided into several branches, one supplying the dental pulp, others the gums. The main blood supply of the root or periodontal fibers passes down between the root and the alveolar process to the gingiva. Thus, the circulation of the upper teeth is downward, and that of the lower teeth, upward. This should be borne in mind in mouth brushing. The brush should be so used that blood is forced upward from the upper teeth and gums and downward toward the lower teeth and gums.

To help a patient get a mental picture of the circulation in the mouth, this is demonstrated in his own mouth, and he is shown how the venous blood is forced into circulation and replaced by arterial blood.

It may be helpful to list a few of the questions that are asked frequently by patients, with suggested answers:

1. *How stiff a brush should one use?*

As stiff as can be had. The gum tissue is the same as that covering the palms and soles, and the more the gums are massaged with the brush, the firmer they will become, if the massage is done correctly.

2. *How hard should one brush?*

Brushing should be as vigorous as it can

be without causing pain or discomfort. Up to that point, it promotes circulation; beyond that point, it irritates. All stimulation possible without irritation is desired.

3. *What are the first symptoms of periodontoclasia?*

Symptoms that the patient will notice are inflammation and bleeding of the gums and sensitiveness to the brush; later, looseness of the teeth and tenderness on biting.

4. *What is the best dentifrice?*

All dentifrices should be considered not as medicine, but for their scouring or abrasive properties. I prefer a powder because it can be more effectively used than a paste. Use of any dentifrice will stimulate the flow of saliva. A paste is generally used (many of the profession teach what the manufacturer tells us, be it right or wrong) by placing a ribbon of paste on the length of the working part of the brush and proceeding to brush. The average person begins on the upper central incisors and works distally until the molars are covered. By this time, the mouth has become uncomfortably filled with saliva, and because of the mechanical action of the brush, about half of the paste has worked between and over the teeth into the saliva. Not wishing to swallow this, he spits it out. The working ends of the bristles are now well filled with plaque—a point that few patients relize. What they do realize is that if they rinse the brush at this point, they will "waste" paste and have to take a second supply. Therefore, they continue to brush the rest of the mouth with the saliva and plaque-filled brush, what little paste remains now being deep in the bristles where it is ineffective. Another reason that I prefer powder is that it is very difficult to rinse all paste out of a brush, and whatever remains softens the bristles at their base and renders them ineffective.

A powder can be applied by just touching the tips of the bristles and brushing a section of the mouth the length of the working part of the brush. When this area is brushed, the brush is removed and rinsed, and with a clean brush and a fresh supply of powder, the procedure is repeated, another section being brushed until the whole mouth is clean. Each section is brushed with a clean brush and fresh powder, and when the process is complete, the brush is easily cleansed of the remaining dentifrice.

While brushing a patient's mouth, I can impress on him the idea of so manipulating the brush as to work this powder between the teeth, where most of the plaques are found. Thus, two important points are gained: the removal of plaques and the increase of circulation in the gum septum.

To do anything well, one must be systematic. When teaching mouth brushing, I always begin in the same location in a patient's mouth and brush in a prescribed direction. Thus, he comes to know, by the sense of touch, when he is brushing correctly. I tell my patients that they will be repaid for exactly the amount of energy they exert, and the intelligence with which they exert it. I use the Charter principle of brushing.

Learning thorough mouth brushing gives a patient the opportunity to exercise *one* effective preventive measure against decay and periodontoclasia insuring a clean mouth with good circulation in all the tissues. Maintaining a clean mouth is accomplished by intelligently massaging the gums between the teeth with a toothbrush and powder as directed, starving bacteria by keeping the mouth clean and feeding the tissues by stimulating circulation. If in addition to teaching thorough, intelligent mouth brushing, the dentist can make the patient realize the fundamental relation between diet and health of teeth and gums, not to mention general health, two long strides will have been taken on the road to health.

SELECTION AND ARRANGEMENT OF ARTIFICIAL TEETH FOR COMPLETE PROSTHETIC DENTURES*

By WALTER H. WRIGHT, D.D.S., Ph.D., F.A.C.D., Pittsburgh, Pa.

THE suggestions contained in this paper are based primarily upon clinical observations on the selection and arrangement of artificial teeth for edentulous patients. While no effort is made to present an exhaustive study of this subject, it is hoped that the following clinical data will enable the general practitioner to select and arrange artificial teeth in harmony with the esthetic and functional requirements of his patients. The first part of the paper will be devoted to the selection of teeth under the headings: form, color, size and type. The latter part of the paper will deal with the arrangement of: maxillary anterior teeth, mandibular anterior teeth and posterior teeth.

SELECTION OF ARTIFICIAL TEETH

Form.—Much has been written about the relation between the form of artificial teeth and the shape of the patient's face. The work of Berry[1] and Williams[2] brings to mind the well known studies of tooth and face forms of the human race. A recent clinical study of the face forms and tooth forms of young adults showed that approximately 64 per cent of those examined had upper central incisors of the same general outline form as that of the face; while, in 36 per cent, the tooth form was different from the face form. Further, it was found that most of the faces were of the modified tapering and tapering-square form, as shown in Table 1. There were 86 per cent of modified tapering, square and ovoid faces, and only 14 per cent of typal faces, all of which were tapering in form.

TABLE 1.—FACE FORMS IN GROUP OF YOUNG ADULTS, SHOWING MAJORITY OF TAPERING

Tapering				Ovoid	Square	Ovoid	
Forms				Forms	Forms	Forms	
1-2	3	4-6	5	3-4	4-5	1-2-3	1 2
3%	11%	38%	30%	11%	7%		

When the form of the natural teeth of each young adult was compared with the form of the artificial teeth on several current mold guides, the data shown in Table 2 were obtained. This tabulation shows that twenty-three had typal square teeth, three had typal ovoid teeth; while six had unusual teeth the form of which could not be matched by any tooth on the several mold guides. When Table 2 is compared with Table 1, it will be seen that there are typal square and typal ovoid teeth, but no typal square or ovoid faces in the group.

*Read before the Section on Full Dentures at the Seventy-Second Annual Midwinter Clinic of the Chicago Dental Society, Feb. 19, 1936.

1. Berry, F. H.: Disc., Proc. 7th Ann. Inst. D. Pedagogics, December, 1903, p. 125; Is the Theory of Temperament the Foundation to Study of Prosthetic Art? Dentist's Mag., 1:405 (April) 1906.

2. Williams, J. L.: Temperamental Selection of Artificial Teeth a Fallacy, D. Digest, 20:63 (Feb.); 125 (March); 185 (April); 243 (May); 305 (June) 1914.

From further observations, it may be inferred that the varied combinations of face form and tooth form are dependent on hereditary influences. Genetically, the form of the face and the form of the teeth may be separate hereditary factors capable of combining in accordance with well-established genetic laws. When studied from this point of view, we found, as shown in Table 3, a majority of tapering faces associated with tapering, square and ovoid teeth. Also, few modified square and modified ovoid faces, associated with square, tapering and ovoid teeth, were found. As might have been predicted, there are nine major combinations with the tapering face-tapering tooth combination exceeding in frequency all of the remaining combinations. Presumably, the present trend in large centers of population is toward a modified tapering face form associated with tapering or tapering-square teeth.

In spite of the fact that more than one third of these young adults had natural tooth forms differing widely from their face forms, none of their faces appeared incongruous, nor were the esthetic values of the physiognomy impaired. Perhaps this phenomenon can be explained by three observations: First, it is rather difficult to detect disharmony between the face form and tooth form, because the natural teeth are relatively small as compared with the entire face. The patient or his friends, having had no training in this field, are unaware of an esthetic relation between tooth form and face form. Figure 1 shows a young man with ovoid face and extremely tapering teeth. Figures 2 and 3 show tapering faces with square teeth. Secondly, natural teeth, of whatever form, are generally arranged in an arch alinement that harmonizes with the contour of the face. It is not unusual, in a tapering face, to find square or ovoid central or lateral incisors that are overlapped as would have occurred had they been tapering teeth. It is, likewise, not uncommon to find characteristic tooth alinements in faces wherein we would not expect them. Figure 1 shows an ovoid face with overlapping tapering teeth. Thirdly, we have often been compelled, in the past, to select artificial teeth that differed in form from the patient's face, especially when the teeth had recently

TABLE 2.—TOOTH FORMS IN GROUP OF YOUNG ADULTS, SHOWING MAJORITY OF TAPERING FORMS

	Tapering							Ovoid		Square					Ovoid		
Unmatched	1M	2M	3M	4M	5M	6N		3U	4U	4B	5C	1C	2C	3C	1W	2U	Old Form Guide
	21	22	23	24	25	26	27	33	34	14	15	11	12	13	31	32	New Form Guide
	1	2	3	4	5	6	7	3	4	5	5	1	2	3	1	2	Wavrin Form Guide
6	8	4	12	10	19	10	1	2	4	14	–	8	11	4	2	1	

been extracted. Such compulsory departures from the present theories of tooth form were in the main quite satisfactory to the patient. Disregarding the numerous exceptions to the harmony of tooth and facial form found in nature, the present method of harmonizing tooth form with face form offers a simple and esthetically sound practice in tooth-form selection for edentulous mouths.

The selection of tooth forms may be simplified by mounting square, tapering and ovoid upper anterior teeth in rubber or condensite models as shown in Figure 4. These form-selection models may be successively tested in the patient's mouth,

TABLE 3.—NINE COMBINATIONS OF TOOTH FORM AND FACE FORM

Association of Tooth and Face Form								
Square Face			Tapering Face			Ovoid Face		
Teeth			Teeth			Teeth		
Square	Tapering	Ovoid	Square	Tapering	Ovoid	Square	Tapering	Ovoid
4	3	1	21	62	10	3	4	2

when in doubt as to the most harmonious tooth form.

In selecting the form of artificial teeth, I suggest that:

1. When available, photographs, models or preextraction records of the form of the patient's own teeth should be consulted, even though it may not be desirable to imitate the natural teeth.

2. Visual and mechanical aids (such as the Wavrin guide), to determine the form of the face and its associated tooth form, should be used.

3. More latitude should be taken than is demanded by present methods of form selection; i. e., departure from a fixed mechanical rule in order to imitate desirable effects as found in nature.

4. The patient's desires should be considered, even though a compromise may later be necessary. Patients who have retained their natural teeth for the better part of their lives do not ordinarily have much to gain by a marked change in the form of artificial teeth, especially when the change is made simply to follow a rule. For example, an anterior tooth on a partial upper denture must match in form the patient's remaining anterior teeth, even though it does not match the patient's face form. Likewise, it is sometimes desirable to have the teeth for a complete prosthetic denture match the patient's own teeth even though they differed in form from the patient's face. In fact, it might be difficult to justify the use of a tapering tooth in a tapering face after the dentist had made a partial denture, or a bridge, using square teeth to match the patient's own square natural teeth.

5. When a compromise must be made between tooth form and tooth size, in full denture prosthesis, it is better practice to select the correct size.

6. The operator should not hesitate to try tooth forms other than the one he thinks is satisfactory.

7. The most natural appearance and, at the same time, the most functionally efficient teeth for each patient should be the aim.

Color.—A clinical study of color in natural and artificial teeth simplifies the selection of tooth color in complete denture prosthesis. From a practical standpoint, there is need of a very limited number of colors to satisfy the requirements of complete denture patients. A brief summary of clinical findings follows.

In one group of about 400 edentulous

patients of various ages, the following shades, in the order of frequency of their occurrence, 7, 16, 8, 20, 6, 9, 5, 11, 21 and 10, were satisfactory. A group of students between 20 and 30 years of age were examined, and the following colors, in order of frequency of their occurrence, 5, 7, 4, 6, 8, 16, 10, 11, 2, 9 and 15, were found. The following shades were common to both groups: 5, 6, 7, 8, 9, 10, 11 and 16. In addition to these eight shades common to both groups, shades 20 and 21 were used in full dentures, while shades 4 and 15 were found in the natural teeth of young adults. These four shades (4, 15, 20 and 21) were added to the eight common shades, a total of twelve shades for use in complete denture prosthesis resulting. We may safely assume that the following shades, 4, 5, 6, 7, 8, 9, 10, 11, 15, 16, 20 and 21, will meet the needs of the average practitioner in rendering complete denture service.

In a similar manner, it has been found that shades 36, 39, 41, 42, 43, 45, 46, 49, 51, 52, 53, 54 and 57 of a new line of teeth will meet the same general requirements of complete denture service.

Tooth color suggestion chart: Edentulous patients may be classified according to age and complexion for purposes of tooth selection. Natural teeth gradually become darker with age. This change in color is estimated at approximately one shade darker for each succeeding ten-year period. This observation makes it possible to classify the great majority of edentulous patients into three age-groups; namely, 30 to 40 years, 40 to 50 years and 50 to 60 years. It is possible to further classify these patients into complexion types, as described in "Color in Teeth."[3] By combining these three factors, age, complexion type and tooth color, it is possible to provide tooth color suggestions, as shown in Table 4. This tabulation is to be used as a suggestion only, when selecting teeth for any one of the twenty-four age and complexion combinations shown therein.

The tooth color suggestions provide a

TABLE 4.—TOOTH COLOR SUGGESTIONS

	Old Shade Guide			New Shade Guide		
Complexion Types	Age 30-40	Age 40-50	Age 50-60	Age 30-40	Age 40-50	Age 50-60
Flaxen Blonde	4, 5	7, 8, 10	9, 20	36, 39, 41	42, 43	46, 51
Gray Blonde	5, 6	7, 8	10, 16, 20	39, 41	42, 43	45
Auburn Blonde	4, 5, 6	7, 8, 9	15, 16, 20	36, 39	41, 51	52, 53
Medium Fair	6, 7	8, 10	15, 16	39, 41	42, 43	45, 46
Medium Brown	7, 8	15, 16	20, 21	41, 42	43, 45	46, 52, 53
Light Brunette	6, 7	8, 10	16, 20	42, 43	45, 46	49, 53
Medium Brunette	7, 8	16, 20	21	41, 42	45, 53	54, 57
Dark Brunette	7, 8	16, 20	15, 21	41, 42	43, 45, 46	49, 52, 53

3. Color in Teeth, New York: The Dentists' Supply Co., 1930.

definite starting point in color selection. Having the complexion type and the age of the patient in mind, the operator tests the suggested color, or colors, instead of searching aimlessly through the shade guide, as is generally the custom. If the suggested colors should prove inharmonious, those listed in the next younger or older age group may be tested. A suitable color for a large majority of edentulous patients may be selected in this manner. The unusual patient must be dealt with according to the operator's best judgment.

Fig. 1.—Ovoid face with typal tapering teeth.

Fig. 2.—Tapering face with square teeth.

Instead of using a single tooth of the ordinary color guide when selecting tooth

color, I prefer the use of color selection models that have six anterior teeth mounted in vulcanite or condensite, as shown in Figure 5. There are twelve of these color selection models, each representing one of the specified twelve shades of the old color guide. (Twentieth Century color guide.) Likewise, there are thirteen color models in the new color guide (new "Trubyte" color guide); a total of twenty-five color models in all. Details of form and size of the selection models are shown in Figure 6.

order that denture base material of harmonious color may be selected. Since color plays such an important rôle in everyday life, it is imperative that the dentist not be found wanting in the color phase of his service.

The following suggestions may prove helpful in selecting artificial teeth of the desired color:

1. The patient should be in a clear and unmodified light from the northern sky. Direct sunlight is to be avoided. Reflected light from green trees, colored buildings or colored office furniture is unsatisfactory.

2. The patient's clothing should be covered with a neutral colored apron (preferably gray). The use of highly colored cosmetics by the patient causes confusion in selecting tooth color. Allowance is made for temporary changes in the patient's complexion owing to poor health, sun-tanning, etc.

3. Whenever possible, not more than three test colors are used for each patient. These may be selected by referring

Fig. 3.—Tapering face with square teeth.

These color guides are kept in an antiseptic solution in a glass container, from which they may be removed and tested in the patient's mouth as shown in Figure 7. Black carding wax may be added, when required, that the patient may hold the color selection model in a natural position in the mouth during observation.

It is further desirable to prepare, in the same manner, a sample of the several hues of pink vulcanite or condensite, as shown in Figure 8, that these may in turn be tested in the patient's mouth in

to the color suggestions. Each moistened color tooth or model is placed separately in the mouth in order to expose the labial surface for inspection. The operator should glance casually and quickly at the patient's face, then look away and mentally reconstruct the esthetic effect. Teeth

Fig. 4.—Tooth form selection models of square, tapering and ovoid artificial teeth.

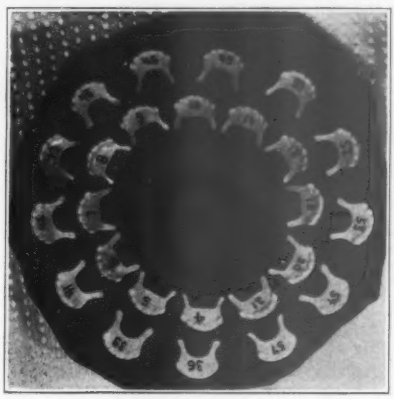

Fig. 5.—Tooth color selection models.

of the wrong color will attract attention owing to their lightness or darkness, whereupon a more satisfactory color may be tested. The selected color should not command attention by standing out above or receding below the general tone of the facial complexion.

4. The patient's preextraction records should be consulted, if available, to learn the color of his natural teeth. The patient or a friend of the patient is consulted about the prospective color.

5. Refractive indexes of natural and artificial teeth are different. Therefore, artificial teeth similar in shade to the patient's own teeth may appear quite

Fig. 6.—Near view of tooth color selection models.

Fig. 7.—Tooth color selection model in patient's mouth.

different when placed in the patient's mouth. Denture base materials also modify the color of artificial teeth.

Size.—The public has, for many years, been thinking in terms of tooth size. Almost all dentists have heard the request for "small teeth" or "large teeth"; which illustrates the public interest in

the size of artificial teeth. Even little Red Riding Hood knew that her grandmother's teeth were too large.

Special preparations must be made before determining what size artificial teeth shall be; which cannot be done accurately until the denture bases, with their contour models, and jaw relation

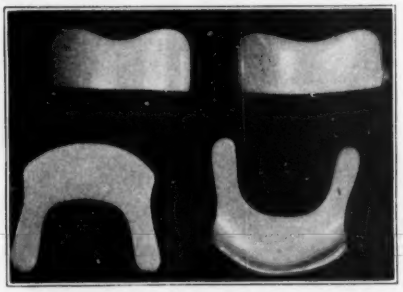

Fig. 8.—Denture-base color selection models.

records, have been transferred to the articulator. It is, further, important that the upper contour model has been built to the fulness of the upper lip, and that the angles of the mouth, the median line and the "high" and "low" lip lines shall have been marked on its labial surface. These markings, shown in Figure 9 *A*, may be cut into the wax or compound, filled with talcum powder and then covered with melted baseplate wax, for protection. When further resorption of the maxillary ridge is anticipated, it is advisable to add about 2 mm. to the length of the upper contour model to provide for future esthetic requirements.

Fig. 10.—Artificial upper and lower incisors showing long and short bite teeth.

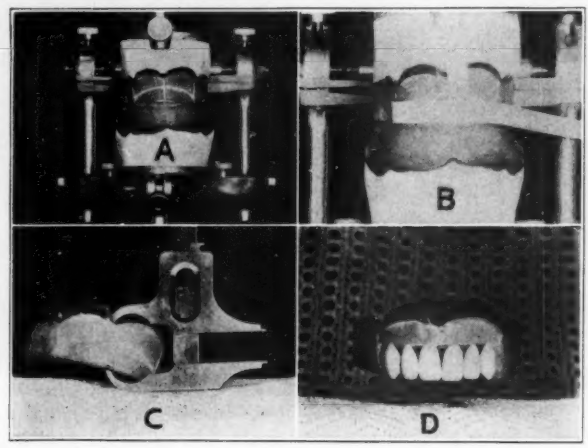

Fig. 9.—*A*, markings on maxillary wax contour model. *B*, measuring available anterior tooth space. *C*, measuring length of available tooth space. *D*, artificial teeth arranged on maxillary contour model for testing.

Available tooth space: The size of artificial teeth is determined by the available tooth space; that is, the available space in which the teeth are to be placed.

This space has three dimensions: (1) breadth (the distance between the lips or cheeks and the tongue, which accommodates the buccolingual or labiolingual diameter of the teeth); (2) length (the distance between the upper and lower residual ridges, which accommodates the length of the teeth, exclusive of the ridge lap), and (3) width (from the median line in the anterior teeth, distally to a point beyond which it is mechanically impossible or biologically inadvisable to extend the posterior teeth). Regardless of other considerations, it is necessary to allow sufficient space distally from the posterior teeth for finishing the dentures. For convenience, the available tooth space may be named for the tooth or teeth that are missing; for example, available anterior tooth space.

Available anterior tooth space: The size of the available anterior tooth space may be determined as follows: The distance between the cuspid markings, on the maxillary contour model, is measured with a flexible millimeter ruler, as shown in Figure 9 *B*. This measurement will indicate the approximate width of the upper anterior teeth. The length of the labial surfaces of the central incisors is determined by measuring the height of the high lip line, as shown in Figure 9 *B*. Further, it is advisable to measure with a Boley gage the length of the space, between the incisal plane of the contour model and the upper anterior ridge, which must accommodate the bite and closure of the upper anterior teeth, as shown in Figure 9 *C*.

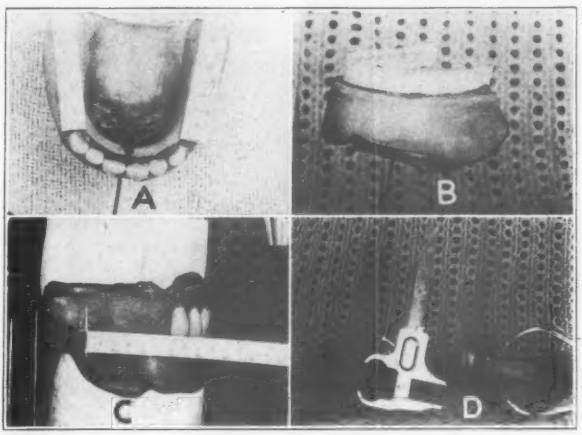

Fig. 11.—*A*, measuring available posterior tooth space of upper contour model. *B*, measuring entire available tooth space of lower contour model. *C*, measuring width of available tooth space of both upper and lower contour models. *D*, measuring length of available posterior tooth space.

Sufficient wax may be removed from the anterior surface of the upper contour model to permit testing of the prospective artificial teeth. These may be held in place by black carding wax, while the upper contour model, as shown in Figure 9 *D*, is being tried in the patient's mouth. Desirable changes should be made at this time. When a short upper lip is associated with a prominent anterior ridge, it may be necessary to use

short-bite, long-ridge-lap teeth. On the other hand, when the lip is long and the ridge is greatly resorbed, it may be necessary to use long-bite teeth, as shown in Figure 10. When possible, a long-bite tooth should be selected.

The width of the lower anterior teeth is determined by the width of the upper anterior teeth, provided the jaw relation is normal. Selection of lower anterior teeth for unusual jaw relations will be described later.

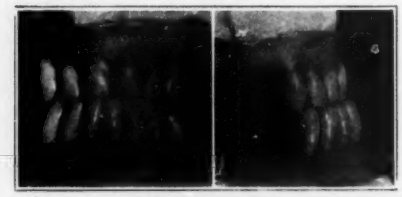

Fig. 12.—Anterior and lateral views of protracted mandible requiring seven lower anterior teeth.

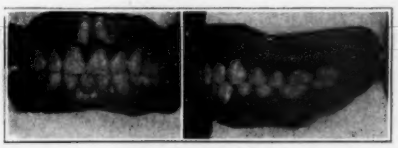

Fig. 13.—Anterior and lateral views of retracted mandible requiring five lower anterior teeth.

Fig. 14.—Selection models showing square, tapering and ovoid alinement of upper anterior teeth.

Available posterior tooth space: Prior to selecting the posterior teeth, the available tooth spaces of both jaws must be measured. In the upper jaw, this is done (as shown in Figure 11 *A*) by measuring from the distal surface of each cuspid to a predetermined point that marks the distal boundary of the posterior tooth space. The lower contour model is measured directly over the center of the crest of the mandibular ridge, as shown in Figure 11 *B*, and on the buccal aspect, as shown in Figure 11 *C*. From these measurements, the width of the lower available posterior tooth spaces is determined. For mechanical reasons, that space, upper or lower, right or left, with the narrowest mesiodistal dimension determines the maximum width of anatomic posterior teeth for both jaws. It is imperative, except when nonanatomic teeth are used, to select upper and lower posterior teeth of the same width, owing

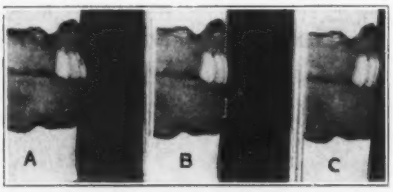

Fig. 15.—Labial, perpendicular and lingual inclination of upper incisors.

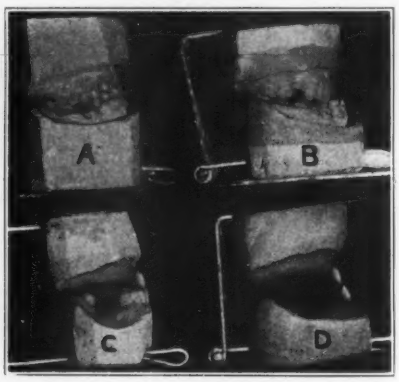

Fig. 16.—Protracted mandible showing natural teeth above and required arrangement of artificial teeth below.

to their cuspal interdigitation, although they may vary in length with the length of the individual tooth space. Artificial posterior teeth are available in widths from 28 to 35 mm.

The length of both upper and lower posterior teeth is separately determined by measuring, as illustrated in Figure 11 *D,* with a Boley millimeter gage. These combined measurements represent the total length, exclusive of the ridge lap, of the posterior teeth that may be used.

Abnormal jaw relations require special care in selecting teeth as to size. When the lower jaw is protracted, a slightly wider set of lower six anterior teeth may be selected; or an extra lateral incisor, as shown in Figure 12, may be added to the previously selected six anterior teeth, the anterior teeth then totaling seven.

Retracted mandibles require anterior teeth narrower than those ordinarily selected to match the upper teeth. It is good practice to use six or not less than five anterior teeth in such cases, as shown in Figure 13. It is better, from the esthetic standpoint, to omit one of the lower central incisors than to select narrower anterior teeth. The selection of molar teeth for retracted cases is difficult because the lower ridge is retracted from 3 to 12 mm. Nonanatomic upper and lower posterior teeth are preferred in these cases to anatomic teeth, since they permit free forward movement of the mandible during the incision of foods. It may be necessary to omit the first bicuspids from the lower arch, or to select narrower posterior teeth for both upper and lower jaws, owing to the diminished circumference of the lower ridge. When nonanatomic teeth are used, the width of the upper and the lower posterior teeth may be different; while anatomic teeth require upper and lower posterior teeth of the same width.

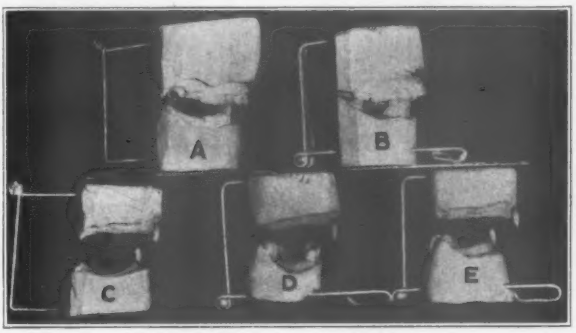

Fig. 17.—Retracted mandible showing natural teeth above and required arrangement of artificial teeth below.

In selecting artificial teeth as to size, the following suggestions may be helpful:

1. Artificial anterior teeth need not correspond exactly in size with the patient's own teeth. Frequently, teeth one size smaller are large enough.

2. The buccolingual diameter of the artificial posterior teeth, particularly of the molars, should be less than that of the natural teeth.

3. Anatomic upper and lower poste-

rior teeth must be of the same width; nonanatomic teeth may differ in width.

4. Abnormal jaw relations require modifications in the size and number of artificial teeth.

Type of Artificial Posterior Teeth.—Until recently, anatomic posterior teeth have been used almost exclusively, regardless of the patient's requirements. Now, there are nonanatomic teeth, which, no doubt, have their place in dental prosthesis. As it is perhaps too early to estimate the value of nonanatomic teeth, most dentists continue to use posterior teeth of anatomic molds for all edentulous patients. Nonanatomic teeth, of present design, have been found useful in unusual cases, such as (a) retraction of the lower jaws; (b) extensive resorption or irritation of the ridges, and (c) resorption in active progress.

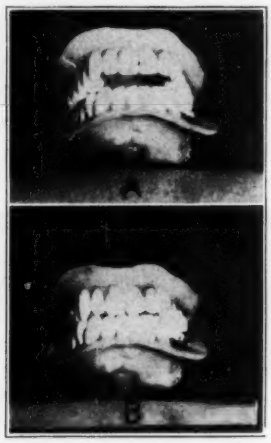

Fig. 18.—Prosthetic dentures for retracted mandible showing teeth in centric relation (*A*) and incisive occlusion (*B*).

ARRANGEMENT OF ARTIFICIAL TEETH

Arrangement of Maxillary Anterior Teeth.—The maxillary anterior teeth, having been selected and purchased, are now arranged on the upper contour model in harmony with its requirements. Owing to the temporary nature of the alveolar residual ridge, it is unwise to place too much dependence on the form of the ridge when arranging the teeth. In general, the alinement of the six anterior teeth should be harmonious with the desired fulness and curvature of the upper lip. Since the upper lip is supported by, and will later adapt itself to, the labial surface of the denture, it is advisable to arrange the teeth in square, tapering or ovoid alinement, shown in *A, B,* and *C,* Figure 14, as required by the esthetic considerations of the lower third of the patient's face. The inclination of the upper anterior teeth is important. Too often, artificial anterior teeth are (Fig. 15) inclined toward the lip (*A*), when in reality natural teeth are generally parallel with the long axis of the profile (*B*) or slightly inclined toward the lingual aspect (*C*). In *B* and *C,* light is reflected downward from the teeth in a more natural manner, as may be shown by the use of a mirror and an electric light. The esthetic effect can be further enhanced by slight irregularities in the rotation, inclination, elongation and labial alinement of the anterior teeth. These irregularities tend to disperse the reflected light and to reduce the artificial appearance of porcelain teeth. Extreme irregularity of the upper anterior teeth is undesirable, since they tend to reduce the incisive efficiency of the teeth and interfere with phonetics and are less hygienic. Also, the patient usually tires of exaggerated irregularity in artificial teeth, just as he dislikes irregularity in his own natural teeth.

Arrangement of Mandibular Anterior Teeth.—The arrangement of mandibular anterior teeth for normal jaw relations is generally well understood by the

profession, but abnormal relations, such as protraction and retraction of the mandible, may well be discussed at this time. As protracted mandibular ridges are larger in circumference than the opposing maxillary residual ridges, the cuspal relations of artificial anterior teeth must be modified. There is an erroneous idea among dentists that the anterior teeth of prosthetic dentures should be arranged with a normal overjet and overbite in all cases. That such a concept is untenable is seen in Figure 16. Here are shown two protracted mandibles (*A* and *B*) with the natural lower teeth in anterior occlusion. If prosthetic dentures

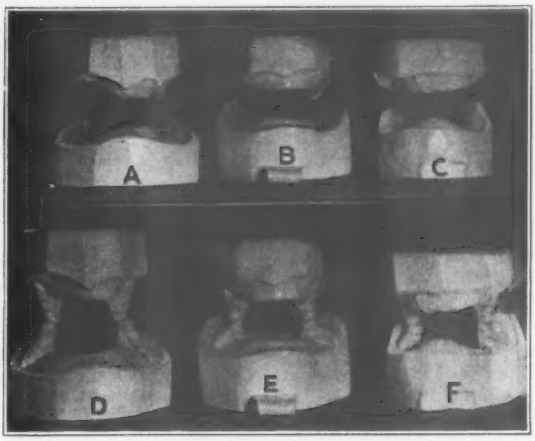

Fig. 19.—Arrangement of molars as required for wide, average and narrow mandible.

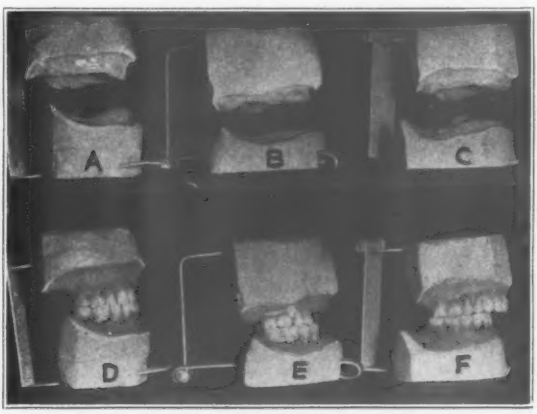

Fig. 20.—Arrangement of posterior teeth for short, average and long mandible.

were to be made to meet these extreme conditions, it would be necessary to place the artificial teeth in about the same position that the natural teeth now occupy. Otherwise, the lower anterior teeth would have to be placed off the ridge, and mechanical difficulties would be encountered. Models *C* and *D*, Figure 16, of similar jaws show artificial teeth arranged in anterior occlusion in

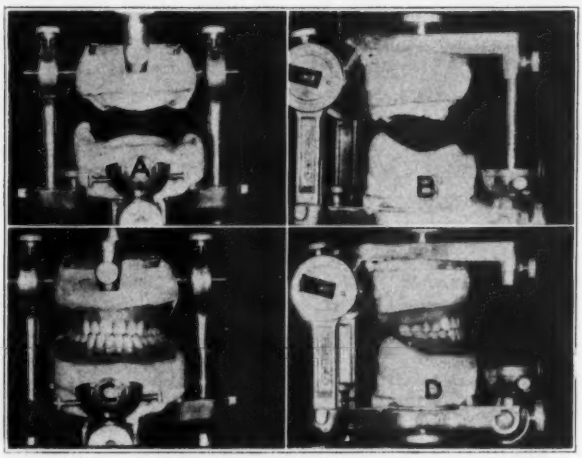

Fig. 21.—Protracted mandible treated by arranging anterior teeth edge to edge and posterior teeth in cross-bite relation.

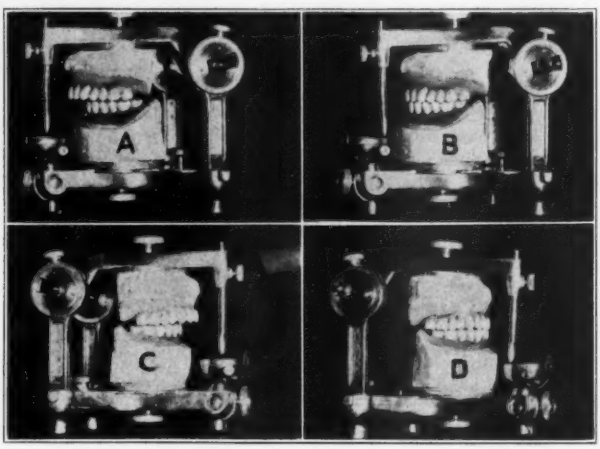

Fig. 22.—Retracted mandible improperly treated in centric relation (*A*) and incisive relation (*B*) with anatomic teeth; and properly treated with nonanatomic teeth (*C* and *D*).

keeping with the esthetic and mechanical requirements of the patient's abnormal jaw relation.

In such jaw relations, it is necessary to use for the lower six anterior teeth wider types; or to use an extra incisor as required by the available space. In extremely protracted relations, the lower anterior teeth may be inclined to the lingual aspect, the arrangement of the natural teeth thus being imitated.

Retracted mandibles, likewise, require special arrangement of artificial anterior teeth, as shown in Figure 17 (*A* and *B*), in which the mandibular anterior teeth are in marked lingual occlusion. To set

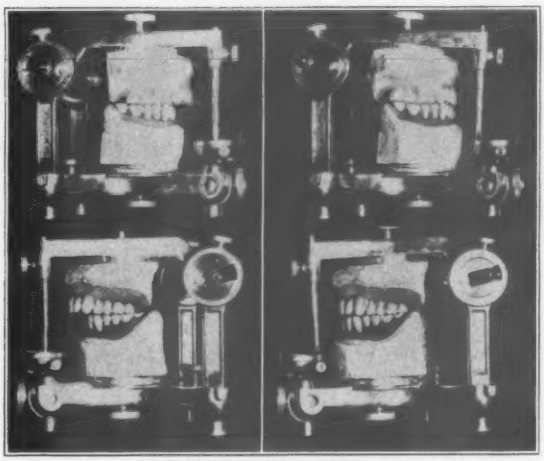

Fig. 23.—Retracted mandible showing centric and incisive balance with nonanatomic teeth.

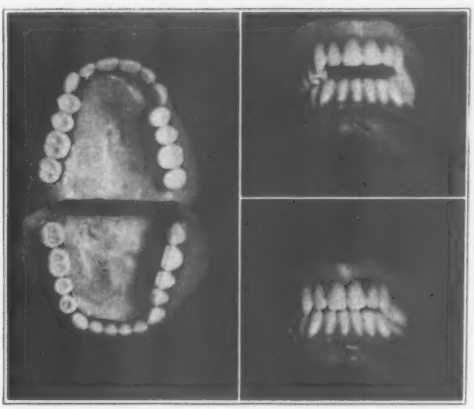

Fig. 24.—Tooth alinement and overjet required by a retracted mandible.

the anterior teeth in front of the lower ridge would be contrary to the arrangement of the natural teeth and unsatisfactory from the mechanic and esthetic point of view. Models *C, D* and *E* of the same figure show the position in which artificial teeth will function most effectively. Figure 18 shows the artificial teeth arranged for a retracted mandible in (*A*) centric and (*B*) incisive occlusions. Attention is called to the great overjet of the anterior teeth, which imitates that seen in *A* and *B* of Figure 17.

Arrangement of Bicuspids and Molars.—The position of the mandibular posterior teeth is, mechanically, more important than the position of the maxillary posterior teeth. It is universally accepted that the buccal cusps of the lower posterior teeth should be placed directly over the crest of the mandibular ridge to avoid instability of the lower denture. Figure 19 shows three models of edentulous jaws, with a large mandible and small maxillae (*A*), with normal jaws (*B*) and with large maxillae and a small mandible (*C*). In *D, E* and *F,* Figure 19, the mandibular molars are placed directly over the crest of the ridge as required; but the upper molars, in *D,* are in cross-bite occlusion; in *E,* they are normal, and in *F,* the upper arch is constricted.

Figure 20 further illustrates the dependence of tooth arrangement on the ridge relation. Models *A* and *D, B* and *E, C* and *F* are the same except that teeth have been arranged on *D, E* and *F.* Model *A* shows a short mandible, *B* a normal mandible and *C* a long mandible. It will be observed that in *E* (the normal mandible), eight posterior teeth were required; in *D,* there was space for only six posterior teeth; while in *F,* four upper posterior and only three lower posterior teeth were used.

Protracted Mandibles.—There remain two abnormal and important arrangements of the posterior teeth; namely, for protracted and retracted jaws. Models *A* and *B,* Figure 21, show a front and lateral view of an extremely wide protracted mandible; while model *C* shows the arrangement of cross-bite posterior teeth, and model *D* an edge-to-edge arrangement of anterior teeth to meet the functional requirements of this jaw relation. Patients with such jaw relations are deprived of normal incisive function and must use a lateral shearing action of the anterior teeth, which is most effective in the region of the cuspids. Cross-bite posterior teeth must be judiciously used and only when the mandible is considerably wider than the maxillae. Regular anatomic or nonanatomic posterior teeth will ordinarily meet the requirements of protracted mandibles.

Retracted Mandibles.—The problem of arranging posterior teeth for retracted mandibles is somewhat involved owing to the incisive function, during which the lower anterior teeth move forward at least one-half inch in extreme cases. As the cusp forms of anatomic teeth do not permit this unusual range of protrusive movement, the teeth may be malocclud ed both in centric and in incisive relations (as shown in Figure 22, *A* and *B*). Nonanatomic teeth, preferably without mesial and distal marginal ridges, are best adapted to a retracted jaw relation as shown in *C* (centric) and *D* (incisive relation) of the same figure. This is further illustrated in Figure 23, in which two types of nonanatomic teeth, showing balanced occlusion in both centric (left) and incisive (right) jaw relations, were used. Finally, the anterior-posterior alinement of the molars and bicuspids in such cases must be nearly parallel on the right and left sides of the jaws as shown in Figure 24 (left). In this nearly parallel alinement, the opposing

upper and lower posterior teeth of the right and left side of the mouth will remain in occlusal contact during the forward movement. Otherwise, the lingual cusps of the lower posterior teeth would occlude with the buccal cusps of the upper teeth when in the incisive relation. Figure 24 (right, above) shows further that a large overjet of the upper posterior teeth is necessary in such jaw relations, when the posterior teeth of the opposite sides are not parallel. The amount of overjet of the posterior teeth must be increased when the posterior teeth are not set in parallel alinement. Figure 24 (right, below) shows the teeth in balanced occlusion in the incisive position.

CONCLUSION

I regret that it has been necessary to confine this paper to the purely mechanical problems of tooth selection and arrangement. It has been impossible to touch upon the subject of articulation and its exacting requirements, or to mention the subject of phonetics and its effect on the arrangement of teeth. The subject of esthetics likewise was for the most part taken for granted.

DENTURE PROSTHESIS—AN ACCREDITED ORAL HEALTH SERVICE*

By H. V. HOLCOMB,† D.D.S., Los Angeles, Calif.

ACCORDING to the dictionary, a thing to be accredited must have the necessary qualifications to entitle it to have attributed to it the essential characteristics that make it worthy of rank or position. It must carry credentials that speak with authority and induce belief in its value and usefulness.

An oral health service is, of course, a service performed for the purpose of maintaining or restoring the health of the mouth. The health of the mouth can mean only one condition; that is, the highest possible degree of function, and tissues that are free from irritation, infection or abuse.

In order to fulfil these specifications, denture prosthesis must take on a meaning that taxes to the utmost degree the intelligence, knowledge and skill of those attempting the service. No other special service of the healing arts surpasses it in difficulties, and I am happy to say no other service surpasses it in meeting some of the almost insuperable obstacles.

Dentures have a multiplicity of duties. First, they should take the place of the natural teeth to the point of enabling the user to masticate food so that he is not restricted to a diet of soft foods or foods especially prepared. They should permit the use of all essential foods that require thorough mastication in their preparation for digestion. Denture prosthesis is not a health service of accredited value unless it restores the function of mastication to an acceptable degree. Artificial teeth can never be so efficient as the natural teeth, but it has been positively demonstrated

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†Deceased.

that we can live and have health with considerable diminution of many of our body functions. Nature overprovided, in most instances, and to be able to take advantage of this provision makes many health efforts successful. Take, for instance the lungs: we use little more than 50 per cent of our lung capacity; which enables the tuberculous victim to lose considerable of his breathing capacity and still regain robust health. It might be well for those engaged in denture service to determine just how well we must masticate our food.

Secondly, dentures should restore the facial contour and appearance so perfectly that it would be difficult to detect that the teeth are artificial. One of the tragedies of the toothless is the complete transformation of the appearance and expression of the face, often from middle to old age, or, worse still, to a caricature of the original self. The possibilities of this branch of the service in contributing to the happiness, the usefulness, of the person so unfortunate as to lose his teeth are unlimited. While looks probably cannot be considered essential to health, nevertheless the effect is indirectly at least a factor in the well-being of the average person.

Thirdly, dentures should not by chronic irritation or alveolar resorption destroy the foundations on which they function or in any way change to soft flabby ridges those that are firm and well-formed. Ridge or tissue change should receive the attention of every denture prosthetist. Many theories have been formulated to account for this condition and many forms of treatment have been devised. Most of the theories and treatments have not met the issue face to face, but have been calculated to account for the change from a systemic aspect, outside the immediate effort of the dentist. Prosthodontists have not been willing to attack the problem as one bound up with the results of their own effort, but, attributing the tissue change to outside factors, have been content to rebase or remake the dentures to restore the lost tissue, instead of seeking the cause where it probably is to be found and saving the patient's mouth from retrograde changes.

Denture prosthesis, as generally practiced today, can make no claim to restoring lost chewing function. Nor can we point with professional pride to the esthetic effects generally evidenced in most denture wearers on parting of the lips. There are few false teeth that do not declare themselves in the pinched, warped and drawn features of their owner. They advertise their presence sight unseen to the untrained eye.

The reason for this all too apparent condition may be that the majority of men in general practice work down to a price instead of up to a standard. They make a hasty, worthless, but unfortunately usable, impression of the mouth, take a meaningless "bite" and send the results to a commercial laboratory with the most meager information or records. The teeth are set in wax on a plain line articulator, or, what is just as bad, on an improperly adjusted so-called anatomic articulator, and after a brief trying in to get the patient's acceptance, the dentures are finished and delivered. The worst part about this is the dentist may get as much as $50 or $100 for this meager and reprehensible service; which encourages him to continue a practice that is surely no credit to our professional endeavors.

I have on several occasions visited some of the best dental laboratories in our community. The unbelievable, grotesque monstrosities made of plaster or stone (mostly plaster, seldom stone) that are sent to the dental technician with the expectation that he can, by some miracle,

convert the pile into a useful dental appliance are beyond comprehension.

It has been said in recently published articles, by two different men, "Through the whole history of research in denture prosthesis altogether too much time and effort have been wasted on the articulator problem. . . . The problem of articulators as far as denture prosthesis is concerned was solved years ago. There are a dozen or more so-called anatomical articulators that fulfill the requirements."

Dentistry has not by any means settled the articulator problem. Dentists as a rule know less about this fundamental than any other phase of their professional service. As a member of the Gnathological Society, I have had the opportunity to work on this problem for the last eleven years. I have seen every commercially available articulator scientifically tested, and not one of them meets the requirements of denture prosthesis. I am sure if the authors of these statements could see the tests made, they would change their minds.

The requirements of an articulator for denture prosthesis are no more and no less than the accurate and positive duplication of the movements of the mandible. Duplications of jaw relations are of paramount importance and unless paths of motion, not simply some stations in these paths, are reproduced, the articulator is not all it should be.

The statement has been made that 90 per cent of all dentures are constructed on a plain line articulator. If this is true, what have the dental schools been teaching and how do they account for this condition?

The observations of one dentist who had taken several special courses in full denture construction involving the use of special articulators and technics is very significant. He stated that when it became necessary for him to become a denture wearer, he found that the dentures made on a plain line $2.50 articulator functioned just as well as, and were even more satisfactory than, those made on the so-called anatomic articulator by special and elaborate technics. The significance of this observation lies in the fact that an adjustable articulator may not admit of adjustments that more closely resemble jaw motions than the plain hinge. In fact, many of the so-called anatomic articulators actually establish intolerable relations to which the joints of the mandible cannot accommodate themselves. But there is a further significance in this dentist's experience: Where are his actual powers of observation? It has been shown that it took forty years for dentists to controvert the statement made by Bonwill that his straight forward condyle path reproduced with sufficient accuracy the movements of the mandible. Bonwill died still "believing" after his fifty or more years of practice with his instrument. He defended his idea with vehement language from any attempts to question its adequacy.

With the proper gift of observation, this dentist should have been able to see not only that his dentures that were constructed by elaborate means did not behave the same in the mouth as they did in the articulator, but also that errors in cusp relation were present that the mouth could not accept. The plain line dentures were useless as far as function was concerned, but they were at least innocuous foreign bodies that he could tolerate while they more or less painlessly destroyed his ridges and the possibility of his having good dentures. Is Bonwill's mental attitude an explanation of why dentists can't, or refuse to, observe more closely?

It is agreed by all of us, at least nearly all of us, that dentures must be made on some sort of an articulator. If there

were a dozen or more articulators that would do the work required, I am sure 90 per cent of the dentists would not resort to the plain hinge. No, as far as dentistry is concerned, the dozen or more adjustable instruments on the market do not solve its articulator problem. Let me urge every dentist to turn his attention to comprehension of the fundamental principles of dental articulators and, further, urge that when a scientific discussion of this important problem is in progress, he not run away with the statement, "That is over my head."

Articulation of the teeth is a determining factor in the masticating efficiency of artificial teeth. Several attempts have been made to discontinue the use of the word "articulation" in this sense. Our committee on nomenclature suggested "functional occlusion," and "balanced occlusion" came into prominent use several years ago to describe a condition of cusp relationship that resulted from moving the lower teeth from their centric relation. Since the word "articulation," properly defined, covers all these points, why further burden our already over-burdened unscientific terminology with unusable phrases?

By articulation, I mean that the cusps and ridges of all the opposing teeth are interdigitated and the interrelation is such that all points of contact are in harmony with the voluntary and involuntary movements of the mandible as dictated by the temporomandibular joints. When teeth, natural or artificial, are articulated, they function and balance. They might function, that is, chew food, without being articulated, but they would do it at the expense of the well-being of the mouth; that is, they would be antagonistic instead of cooperative in the act of chewing. This lack of articulation might be reflected in injury to the tissues under the dentures. Dentures can be balanced without being articulated, but balance without articulation means that the points of contact are on incline planes, which diverts the lines of force and throws stress and strain in an unwanted direction, with resultant injury to the foundation of the dentures.

Malarticulation I believe to be one of the most common causes of ridge resorption. Some think that trauma is not the cause of resorption, but that systemic conditions are chiefly responsible. If that is a fact, why is there not a more even distribution of the absorbed areas? Why is there sometimes a localized area of absorption in the anterior region of the upper ridge when the lower six anterior teeth have been left in place and no lower partial denture or a badly articulated one is worn. Everyone has seen mouths that have been ruined by such appliances.

The teeth, when normally shaped and properly positioned, are in harmony with the movements of the mandible. Any other condition is malarticulation, which I believe to be the greatest source of ridge resorption. Dentures that are properly fitted to the jaws, with the teeth articulated, should give the highest degree of masticating efficiency and maintain a condition of oral health that should in turn be reflected in the general health and well-being.

That even grossly articulated dentures can chew better was demonstrated by Christensen about twenty years ago in experiments conducted at Copenhagen, Denmark. In 1925, McCollum repeated these experiments in a more elaborate manner on both natural and artificial teeth. Thompson has recently repeated the experiments with artificial dentures. It is plainly evident that proper cusp and ridge relations are essential to good mastication.

If articulation is to be accepted as the measure of masticatory efficiency and the

aim of denture prosthesis, it will be necessary for us to promote in the schools a better understanding of the main factors in articulation. We must know how these factors are interrelated; how the height of the cusps, the slant of the condyle paths, the form of the condyle paths, the inclination of the plane of occlusion and the curve of Spee affect one another, and how the various combinations of these factors may have a given result. We must know how the lateral centers of action are related to the position of the teeth and the forms of the occlusal ridges, and how the overjet and overbite help or hinder the relations of these ridges. The curve of Spee and the inclination of the plane of occlusion are two factors that may be used to great advantage by the prosthodontist in articulating teeth.

The most important part of the occlusal surfaces of the teeth is their ridges. The grooves, pits and fissures of the teeth are incidental to ridge formation. Ridges could not exist without intervening shallows, and the depth of these shallows determines the height of the ridges. Therefore, we are concerned with the ridges in articulation and how they meet the ridges of the opposing teeth. Again let me say that the efficiency of mastication is dependent on the exact interaction of the opposing ridges, all working in harmony with the opposing teeth.

The question, "Isn't it rather strange that the first attempts, and by far the greatest efforts today, to understand jaw motions came from those concerned with the construction of full dentures?" has been put. The explanation of this fact is not difficult. Dentures have soft tissue as a foundation, and this foundation is easily irritated by abnormal or uneven stresses. Prosthodontists are always concerned with the relief of this distress. The natural teeth, being anchored in the bone, can take the pounding and beating until such a time as the natural malarticulation prepares the way for full dentures by knocking the teeth out of their sockets; and so it was the denture men who first noted the necessity for a remedy. The dozen or more anatomic articulators are one of the results of this quest. These attempts have run the gamut of articulating instruments, teeth with and without anatomic form, and all sorts of impression technic. Theories of jaw motions have actuated the attempts to solve the problem instead of actual scientific research methods followed to a logical conclusion. This lack of proper approach has left us confused. When articulators failed, men turned their attention to "mechanical teeth," as though anatomic teeth were not mechanically correct. One man started out with an articulator and very deep cusps to insure good chewing qualities and has now wound up with no articulator and no cusps. Not content with that, he has inverted the cusps and made holes where Nature made cusps.

The movements of the mandible are around two lateral axes of rotation. These lateral movements, together with the downward slant of the condyle paths, make two separate arcs of motion. Nature put cusps on teeth to make them consistent with these movements and by no mechanical or physical process can this be avoided. Of course, one might reverse the interpretation and say that these motions are consistent with the cusps but, nevertheless, both components of the arrangement are there. The form and slant of the condye path and the arcs of the lateral movement are furnished by the patient. They must be matched in our efforts or our work is a failure. The slant of the plane of occlusion and the radius of the curve of Spee can be used to modify the height of the cusps, but cusps cannot be entirely eliminated. The relations

of the edentulous ridges would, in very few cases, permit a slant of the occlusal plane that would make this possible. Evidently, from the general set up of most of the artificial teeth, particularly those using cuspless, low cusp or channel teeth, this fundamental element in the arrangement of teeth has never been heard of. Cusps on teeth made to harmonize with all the factors in the movements of the mandible and the position of the teeth in relation to these factors are a necessity. Cuspless teeth cannot be balanced, much less articulated, all the claims of the manufacturers and dealers to the contrary notwithstanding.

Reporting the findings of the Gnathological Society, McCollum says:

> The motions of the mandible are dictated by the temporo-mandibular articulation and are confined to the limits of the flexibility, adaptability and general arrangements of these joints. Because this articulation is often found attempting to adapt itself to a misrelation of the teeth, a false conception has grown up regarding its positive action. This false notion has gone so far as to lead many dentists to believe that jaw motions are independent of the mandibular joints.

Centric occlusion is one of the most important factors in denture prosthesis. The mandible is in centric relation when the condyles are in their most retruded position. When the condyles are in this position, the mouth can be opened and closed on an axis of motion that has become known as the "hinge axis." For the last fifty years, it has been known that the mouth opens and closes on a biologic hinge. Snow's facebow was invented in recognition of this fact. But only within the last few years has it been known that this axis is a definitely locatable center of action. The cusps of the teeth should be in harmony with what Stallard has termed condylar centric relation. It should not be necessary for the planes of the cusps to drag the mandible forward or sidewise in order for the cusps to interdigitate. A lack of centric occlusion is fatal to the success of full dentures. Centric occlusion is difficult to obtain and many operators try to side-step the issue by destroying any semblance of the centric relation with a rotary grinder or milling device. The effect is as ruinous and as illogical as cutting the cusps off or inverting them because articulation is difficult to accomplish.

In a demonstration involving the work and findings of the Gnathological Society, the precision and character of jaw motions will be shown in a clinic. This information is difficult to impart by the written or spoken word or even by pictures.

Impressions have played a part not second to any other branch of denture prosthesis. Wax, plaster, compound, eugenol cements and other plastic materials have all been used. There is still much room for improvement. The behavior of tissues under dentures is a field for fruitful investigation. Recently, a special technic of impression taking that has undoubtedly helped has been developed by Dr. McCollum in our office.

For making the impression, the front part of the tray is removed so that the behavior of the resilient tissues on the anterior part of the upper ridge can be observed. The placement of this tissue in a pendant position in the denture has created a solid and movement-free denture that promises to solve one of the major difficulties in upper dentures. Dentures so made require no relief and are particularly free from torque. This method was recently demonstrated by McCollum and me before the National Society of Denture Prosthetists in San Francisco. With further development, the method may answer several of the impression problems. A denture can, after all, be no better than the impression.

The proper preparation of the mouth is a problem for the prosthodontist and therefore should not be left entirely to the exodontist or oral surgeon. The extraction of condemned teeth may be an aid or a great hindrance to the success of the prosthetic appliance. Any person who is compelled to lose his teeth should have the services of some one competent to make necessary records of facial contour and tooth form and relation and, most important of all, accurate records of jaw relations. Before the teeth are extracted, even though badly involved, they can serve as a means of attaching the recording devices. These jaw records once made can be used to construct dentures that really articulate. Hooper, DeVan, Jaffe, Stansbery and many others have devised methods to record facial contours and some such method should be used. But the records of jaw motions have been neglected and need to have the attention of every prosthodontist. Immediate denture restoration has been practice in our office as a regular routine for the last fifteen years, but, for the last five years, our records of jaw relation have been the most satisfactory achievement.

In all the fields of prosthetic endeavor, denture prosthesis stands at the head of the list in achievement. The replacement of an eye can do only one thing, contribute to the appearance. The replacement of a lost hand or foot is attended with only a modicum of success. But owing to the particular relation of the teeth to the biotic factors of the masticating mechanism, it is possible to replace them with even more satisfaction than attends the use of glasses in increasing the vision in defective eyes.

Denture prosthesis is an accredited health service when performed according to the best knowledge, judgment and skill available. Hundreds of able men have contributed information, until today, if this science were used in the art of the prosthodontist, there could be no question as to its value as a health service.

METAL DIE TECHNIC FOR CURING VULCANITE AND THERMOPLASTICS*

By CHARLES S. BALLARD, D.M.D., Seattle, Wash.

THE curing of dentures made of rubber or vulcanite is an old process, familiar to all of the dental profession. The term "vulcanite" covers all denture-base rubbers, and as these bases are similar in chemical and physical properties, they need no further classification. The term "thermoplastics" covers numerous kinds of materials. In the general acceptance of the term, thermoplastics are defined as materials that are precured and need only to be changed in form to comply with the form of the denture base.

Many such bases have made their appearance on the market, but since the cellulose and vinyl type resins have been most commonly used, I shall limit my discussion to them.

The principle of curing denture bases

*Read before the Section on Full Denture Prosthesis at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 15, 1936.

in an all metal mold is a matter of employing a medium through which an even heat may be conveyed to the entire area of the denture. I submit for consideration what I believe to be proof that this is an impossible accomplishment through a plaster mold under even the most favorable condition.

The successful construction of artificial dentures is one branch of dentistry requiring the most painstaking impression taking, articulation of teeth and, finally, curing and completion of the case in the laboratory.

Many students are devoting their time and energy unselfishly in an effort to eliminate error incurred in the process of denture construction by the development and application of new methods, equipment and materials to reduce the margin of error in each of these necessary steps.

The perfection of the final step, that of curing the denture base, is the one in which I am attempting to eliminate error by the application of a perfect heat-conducting matrix, thereby eliminating "spotty" or uneven curing. If this is accomplished, most cases of stomatitis or "sore mouth" will, I believe, have been precluded through elimination of warpage and porosity too often occurring when plaster of Paris is used.

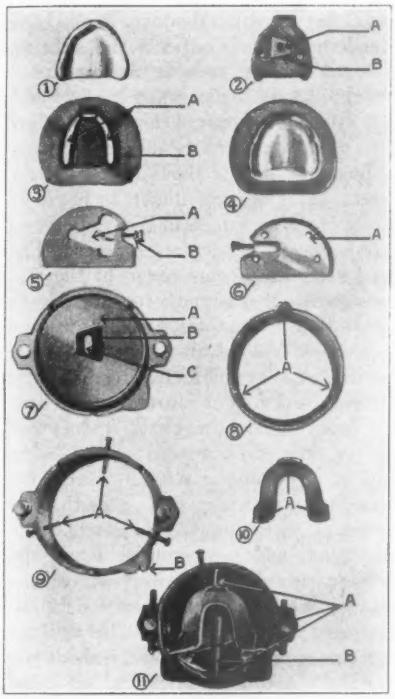
Before discussing the metal die technic, it is important to review briefly the chemical and physical properties of the denture bases under discussion, and also the materials used for molding and curing these denture bases under the present method.

VULCANITE

Vulcanite is a compound of caoutchouc and sulphur. Caoutchouc is the dried milky juice (latex) of various trees and plants found in the tropics. A similar gum capable of vulcanization can be obtained from the common milkweed, goldenrod and other plants of the temperate climates. Caoutchouc is the native Indian name for the substance. The material found an early use in Europe as a means to remove black lead pencil marks from white paper. Its name obviously arose from the fact that it was a product of the Indies. Caoutchouc must have been known in America at a very early period, because balls made from the gum of a tree, very light and bounding, are mentioned by Herrera in speaking of the amusements of the natives of Haiti, in his account of the second voyage of Columbus. Many other authors of the fifteenth, sixteenth and seventeenth centuries not only mention this unusual gumlike material and its uses, but also give a description of the tree that is its source. While the Indians used it more than 300 years ago for water bottles and gum shoes, it was used in the United States and Europe only for erasing pencil marks until about 1820, when it was employed in the water-proofing of cloth. As this material became hard and brittle in cold weather and sticky in hot weather, many experiments were made to overcome these objectionable features; which resulted in the discovery of vulcanite in January, 1839.

Vulcanization, ever since its discovery, has been one of the mystifying problems of the chemist. There are numerous theories advanced, each of which has its group of followers. One thing is definitely known and that is that sulphur in some way actually combines with the rubber molecule. Rubber has a definite affinity for sulphur, and once they have become united, there is no known method of separation that will leave the two substances with the same physical properties as before the union. This union is thought by some to be chemical; by others, physical; while still others believe it to be a combination of the two.

At one time, it was believed that sul-



1, impression ready to be poured. *2*, model core, bottom or mount plate side. *a*, threads to receive bolt through bottom of flask. *b*, raised surface, machined to fit recessed portion of mount plate (*a*, 5). *3*, model table with model core attached. *a*, movable ridge portion of model core. *b*, surface of table machined flat to form perfect base of model. *4*, same as *3*, with model poured and impression in position, showing model to be cone shaped with base formed on machined surface of model plate. *5*, underneath or model side of mount plate. *a*, dovetailed and recessed to receive the raised surface of model core (*b*, 2). *b*, screw to secure model to mount plate. *6*, top or plaster side of mount plate. *a*, studs for plaster to form around and attach to articulator. (At this point, it is assumed that the case is prepared for investing.) *7*, bottom portion of flask. *a*, machined surface of flask bottom. *b*, recessed spot in bottom of flask to receive raised surface of model core (*b*, *2*). *c*, hole through which bolt passes to secure model to flask bottom. *8*, ring with upright slit portions, which, when removed after the case is poured, forms a waste gate. *a*, upright slit portions to hold separator strips in position while case is being poured. *9*, second or ring portion of flask. *a*, screws through sides of flask, points of which engage flat surfaces of *a*, *10*, when flasking case. *b*, projection on flask to aid in handling with pliers when case is hot. *10*, horseshoe occlusal retainer, attached to teeth and lead foil by means of artificial stone. *a*, flat surfaces for points of screws of *a*, *9* to engage, thereby preventing distortion of case during pouring process. *11*, flask and case assembly. (All parts relative to flasking are in place and secured by means previously described. The case is now ready to pour the molten investment up to the height of the occlusal retainer.) *a*, separator strips in position retained in upright slit portions of *a*, *8*. *b*, taper plug which when removed provides thermometer hole.

phur would not unite with rubber until the temperature had passed the fusing point of the sulphur; but this has been definitely disproved. Sulphur will unite with rubber at ordinary room temperatures. In direct ratio as the temperature is increased, the time necessary for vulcanization is shortened. Time and temperature, therefore, become the two important and necessary outside conditions giving the proper quality to the rubber composition.

The old observations recorded by able men like Snow and Wilson and many others tell us that the vulcanizer must be heated slowly from 250 F. to the vulcanization point to allow for the escape of gases generated, or the case will be porous; that thick dentures and rubbers containing little coloring matter or fillers require particular cure, more time, and lower heat; and that even if the denture is not porous, brief vulcanization at too high a temperature will produce a brittle base. The shortest vulcanizing time possible to secure a hard, strong, resilient base should be used. Filling in thick dentures generously with a good pink rubber is a very good practical method of preventing both porosity and shrinkage.

Too long a vulcanization at low heat will cause shrinkage, which will manifest itself more unfavorably in a denture than in a test strip. The material may draw away from the teeth or cause a defective fit, evidenced by a binding on the buccal side of the tuberosities and a loss of adaptation on the lingual side. Deterioration of casts and investment by too long an exposure to steam also contributes to the faulty fitting of a denture. To allow for expansion and to follow the contraction, the technic of holding the flask in spring pressure should be followed.

The findings just presented are a summary of results established over a long period of time with the use of steam vulcanizers and a plaster mold.

It becomes apparent that recordings of vulcanization temperatures are incorrect and confusing and should be changed, as the actual temperature inside the vulcanizer is almost 20 degrees higher than that indicated on the thermometer and gas regulator. Mr. John H. Lewis, of the Buffalo Dental Manufacturing Company, says, "The story of this error goes back over fifty years, but as all American manufacturers in developing dental vulcanite used our vulcanizers and thermometers and published their instructions accordingly, we have found it wise to continue to build all our machines with this same inaccuracy of temperature reading." Most cases are therefore vulcanized at from 337 to 340 F. and not at 320 F., as the reading on the machinery indicates.

In the past four years, I have made many experiments in vulcanizing rubber in both plaster and metal molds, using dry heat. There seems to be a much greater penetration of heat by this method than by steam. If a case is allowed to remain in the oven at 335 F. for eighty or ninety minutes or even an hour, it becomes brittle and porous.

While vulcanite dentures have been a godsend to both patients and dentists and will continue to be for many years to come, progressive men must be alert and not overlook improved materials when their merit has been established. In my opinion, the dentist should, to a certain extent, carry on experiments to prove or disprove the usefulness of the leading materials offered the dental profession. The final acceptance or rejection of the material will be hastened considerably if this is done.

Some of the advantages of vulcanite are its ease of manipulation, repairability, inexpensiveness and durability. There are many disadvantages, as it does not convey thermal changes and, being porous, it becomes a good incubator for bacterial production and growth, the causes of which may tend toward ridge absorption and sore mouth. From the esthetic point of view, it is one of the poorest denture bases in use today. In the past, patients of the middle and upper classes complained mostly about the unesthetic nature of vulcanite, but today few, if any, patients, regardless of class, wish to have a vulcanite denture.

CELLULOID

As I find practically all authorities in agreement on the essential points regarding celluloid, I take the liberty of quoting from a paper by I. Lester Furnas, of Cleveland, Ohio[1]:

When vulcanite first became popular as a base material, the Goodyear Rubber Company obtained from the United States Government a process patent and proceeded to collect royalties from the dental profession for the vulcanite denture bases which they constructed. This soon led to much litigation in the courts and also a

1. Furnas, I. L.: Choice of Base Material for Artificial Dentures, J.A.D.A., 17:3 (Jan.) 1931.

wide search for a suitable base material to take its place. An Englishman named Parks had only recently invented a plastic vegetable compound . . . which was later to be called celluloid.

In 1860, Dr. McClelland, of Louisville, Kentucky, made some valuable improvements on this material, rendering it very desirable as a denture base material, and gave it the name of "rose pearl." For a time, this product was very popular, but owing to the settlement of the Goodyear process patent litigation and the development of many objectionable features, it soon fell into disuse, so much in fact that, for the past thirty-five years, a celluloid denture in many localities has been somewhat of a curiosity.

About 1915, this material again made its appearance. This time, it received its stimulus from a European concern, but its progress was almost totally halted by the World War, which was in progress at that time. Since the settlement of that great conflict, similar materials have reappeared, the most popular one in this country being sold under the trade name of "hecolite."

Celluloid is made from pyroxylin, or the woody or fibrous parts of plants. This material is treated with nitric and sulphuric acids, after which it is known as nitrocellulose or guncotton, a highly explosive substance.

The proportions of this material with other substances as used for denture base materials, are about as follows: guncotton, 100 parts; camphor, 40; white oxid of zinc, 2, and vermilion, 0.06.

Zylonite is made by first dissolving the guncotton in ether or methyl alcohol and then combining it with the other ingredients. Celluloid is made by effecting the union of several ingredients by means of heat and pressure without first dissolving the guncotton.

Pure celluloid, as it is manufactured, is a pale amber, almost as transparent as glass. If one desires to make it white like ivory, oxid of zinc is used. For other colors, various materials and pigment are incorporated in it, or dyes soluble in alcohol, or any of the anilin dyes may be caused to permeate the material and give it the desired color.

The merits of celluloid as a material for a denture may be summed up as follows: It is hard and elastic, having a hardness ranging from horn to that of ivory, is tough as whalebone, and in elasticity, it greatly exceeds ivory. In the conductivity of thermal change, it is so much like vulcanite that it is difficult to distinguish a difference. Celluloid is easily pressed or molded at a temperature of from 250 to 300 F., and has a specific gravity of about 1.4. It is generally believed to be superior to vulcanite in strength. This characteristic is most variable, depending largely on the pressing and curing process. Perhaps its greatest recommendation lies in its esthetic value. Few, if any, base materials have the translucence of celluloid base dentures and its resemblance to living tissue.

The principal disadvantages of this material as a denture base may be enumerated as follows: In some cases, there seems to be a gradual solution of the substance by the fluids of the mouth, which results in a gradual thinning of the base and consequent breakage. When it is used for some time, in many instances, a very disagreeable odor develops, so objectionable that the denture cannot be worn with comfort. The base often becomes badly discolored, assuming a dirty brown appearance. The pressure required to press the base often distorts the cast, which results in faulty adaptation. Many of these disadvantages result from employment of a faulty technic during construction, and should not be credited altogether to the material itself.

Generally speaking, the best results are obtained by pressing celluloid in a dry chamber at a high temperature, continuing the process as long as may be consistent with the work in hand. By this method, the volatile constituents are driven off and the material is rendered more dense and compact, while its elasticity is increased and its color improved over the product resulting from the moist process.

Steam, oil or glycerin softens the plaster matrix and flask investment as well, ren-

dering them more susceptible to compressive force and consequent distortion in closing the flask. When dry heat is employed, the flask contents become hardened by the evaporation of moisture before the compression force is applied, and consequently, there is less liability of warpage and distortion than by the moist method.

The chief objection to the dry method is the danger of burning the celluloid blank during the process of pressing. By the cutting of ample waste gates in the plaster investment surrounding the matrix, so that no surplus material comes in contact with the metal flask, this danger is largely overcome.

An extra large size flask for investment purposes is necessary in order to afford the needed space for deep and wide gates.

The flask should be of the same general form as a vulcanite flask, but larger and heavier throughout. The guide pins should be strong and long enough to hold the two halves of the flask in proper relation to each other when separated by the introduction of the unpressed blank.

The general conclusions regarding celluloid as a base for artificial dentures may be summed up as follows: It is not so durable a material as vulcanite, but it certainly deserves consideration as a serviceable and inexpensive base for artificial dentures, because of its close resemblance to the natural gum tissues.

The discussion just presented relates to the usual procedure employed for processing celluloid. The employment of an all metal mold eliminates many of the objections just presented; but it does not produce a perfect denture base in this material.

Under the discussion of metal die technic and vinyl resins, the reasons that the metal mold is superior will become apparent.

DELETERIOUS PROPERTIES OF PLASTER OF PARIS

Few of the dental profession realized until quite recently, and a great many do not yet realize, to what extent the physical properties of plaster of Paris change on setting when mixed with water under the most favorable conditions. Why or how it sets, or how much pressure it will withstand without becoming distorted, are points of vital importance practically unknown to or at least disregarded by a great number of the dental profession. The tendency for plaster to expand, its susceptibility to compression under load and the deleterious action on it of heat and moisture result in manifold errors and mishaps that lead to impaired adaptation and frequent failures in denture construction.

The recognition by many leading prosthetists of the deleterious effects of the use of plaster of Paris has led to the making of many of the fine plasters and artificial stones that are on the market today. I believe that any one knowing the physical properties of plaster of Paris will agree that it is impossible to mix even the finest plaster with water without incurring expansion, contraction or warpage, or all three.

Edwin H. Mauk,[2] of San Francisco, says:

> In making tests several mixes of each sample of plaster tested were made with varying proportions of water. As each mix was made, several cubes were molded from it. After the time allotted for setting to take place, these were crushed, some dry in the usual manner, and the others placed in the vulcanizer with water, the temperature gradually raised to 320 F. and the crushing pressure immediately applied at that point. In some instances the vulcanizer was allowed to cool, opened, and the cube then removed and crushed. These showed a loss of strength similar to those tested in the vulcanizer but even greater.
>
> This latter test does not bear out the

2. Mauk, E. H.: Conflicting Factors in Use of Flasking Plasters of Denture Rubbers, J.A.D.A., 10: (Sept.) 1923.

claim that has frequently been made to the effect that notwithstanding the softening of plaster during vulcanization it will return nearly to its original strength if the vulcanizer be allowed to cool slowly.

It was found that plaster and plaster compounds which showed surprisingly high resistance when tested dry, lost from 42 to 73 per cent of their strength in the vulcanizer tests. . . .

Some plaster rather widely known and extensively used showed results much lower than any quoted above, so low in fact, that it is astonishing that they are ever successfully used for this purpose.

Impressed by the apparent weakness of plaster in general under these conditions as disclosed by the tests and bearing in mind the possibilities of the expansion force of rubber in vulcanizing, it was determined to make some attempt to ascertain what pressures plaster might have to withstand, for instance, in a bolted flask, also in closing a flask with an excess of rubber without a thorough softening by heat.

It was found by computing the increase of power transmitted through the screw of the ordinary flask press that a pressure of 8,000 pounds or more is often exerted on the contents of the flask by a force of 50 pounds applied to the handle. Think of the enthusiastic efforts of a sturdy young man who is not likely to stop with a mere 50 pounds unless the press breaks or is wrenched from the bench. Then compare the staggering result (only about 16,000 pounds or so) in the interior of the flask packed with a generous surplus of incompressible rubber with the resistance of the best sample of plaster compound. Is it any wonder that teeth are displaced from occlusion when the denture is finished or that the plate is said to have "warped" during vulcanization?

To test the rubber expansion force a steel tube closed at its lower end was fitted in place of one of the rods in the cover of the Edison vulcanizer, so that it extended to the bottom of the pot. A rod was also fitted so that it filled the bore of the tube snugly without binding.

Denture rubber was packed in the tube under a heavy pressure to expel trapped air, heated to drive off moisture, allowed to stand for a period of time to cool, and again put under pressure with the rod in place for the initial measurement of volume. Then with the upper end of the rod in contact with the pressure head of the testing machine, the vulcanizer containing water was slowly heated until the thermometer showed 320 F. as in the plaster tests.

The testing machine registered such astounding force, even at low temperatures, as to create the impression that something was wrong. All items were checked, and found correct. The surface area of the mass of rubber being tested did not exceed three-eighths of an inch in diameter, or approximately 0.125 of a square inch. Therefore, when the pressure reached a total of 1,500 pounds, the experiment was abandoned, since with even this small surface of rubber, an expansive force in excess of the total resistance per square inch of the best plaster investment tested has already been reached, and for the purpose of the research at that time it was useless to continue. As to how much higher pressure could be produced in this way, we may only guess.

It was realized that this particular experiment was not sufficiently complete upon which to base any positive conclusions, but it indicates that no plaster investment is strong enough to withstand the expansive force of rubber rigidly confined to vulcanizing.

Exactly what happens to plaster during vulcanization is, of course, impossible to determine without exhaustive research and special apparatus. Without doubt, one of the changes it undergoes is dehydration, which accounts for its weakness; for when samples which have been treated in the vulcanizer as described are removed immediately upon opening it and are at once examined under the microscope the plaster is seen to "set," that is, form new crystals with great rapidity when water is added, and to show exaggerated expansion in so doing.

It has been possible to establish the point at which dehydration begins at about 225 degrees F., but it is relatively slight and proceeds but slowly up to say 275 F., though much more rapidly at higher temperatures. The expansive force of the rubber sulphur mixture becomes apparent soon after the boiling point of water is passed, and increases proportionately up to about 275 F., after which it is much less.

STOMATITIS

The world of dentistry has listened to discussions and conclusions since the year 1870 regarding the deleterious effects that vulcanite may have on the mucous membranes of particularly susceptible mouths. Chiefly, these discussions have terminated in a sort of concession that the so-called "rubber sore mouth" was attributable to red and pink rubbers which contained vermilion as a coloring matter. It has been claimed that vermilion, chemically known as mercuric sulphide, has been responsible for this condition of the mercury or sulphur, which is supposed to have acted as an irritant to the oral mucosa.

In 1911, Eilerson made a comparative study of carmine and vermilion in the results of which he maintained that the use of carmine as coloring matter overcame the objectionable effects of vermilion. Until 1922, there was much discussion of this matter, resulting in no concrete conclusions. Then the subject seems to have been dropped from the active minds of the profession until Furnas, in a paper read in 1930, relative to the choice of base materials for artificial dentures, maintained that the criticism of vulcanite because of its vermilion content was unscientific. He concluded, from experiments, that mercuric sulphide was insoluble in water, alkalis, alcohol or acids, except nitrohydrochloric acid. He further maintained that the heat of the vulcanizer cannot decompose vermilion, because it is subject to a much greater heat in manufacturing.

The fact has been overlooked that vermilion, being very costly, is subject to adulteration with red lead, red antimony sulphide, baryta white and lead sulphate. The hue of the mixture can be restored to the proper degree by introducing the powerful but fugitive coloring matter eosin. If such adulterated vermilion is used in the manufacture of dental rubbers, it can easily be conceived how the soluble additions might be the source of mucous membrane irritation.

Evidence of conditions simulating "rubber sore mouth" have often been found in persons wearing dentures of vulcanite that did not contain vermilion as coloring matter. Dentures constructed of the newer cellulose, resinous and condensite materials have also produced manifestations that in every way resemble the conditions which are regarded to be attributable to the rubber. The obvious conclusion must, therefore, be that the condition, which is called vulcanite stomatitis, or "rubber sore mouth," may be due to many other conditions associated with denture construction. Very often, the condition may be improperly diagnosed, and may not be due to the dentures at all. It is my opinion that true stomatitis is the result of the use of inferior rubber, which contains cheap coloring matter, and that, in the majority of cases, when the condition appears to be stomatitis, it is only sore mouth due to warping of a denture from the use of inefficient equipment, or to hurrying a case through the vulcanizer and consequently inducing porosity.

Bearing in mind, therefore, the imperfections incurred in mixing plaster of Paris or artificial stone even under the most favorable conditions, it becomes apparent why so many dentures are failures and misfits when processed in the average

laboratory. This is especially true when apprentices are depended on to perform the duty of investing the dentures.

VINYL RESINS; METAL DIE TECHNIC

Before entering into a description of the metal die technic, it would be of value to review the pertinent steps taken to overcome such minor obstacles as are always attendant on development of a new process.

When the vinyl type resins made their appearance on the market, it was believed by a large majority of the profession that the perfect denture was now available. After several were processed with the equipment provided and returned with the vault fractured, conclusions were drawn that either the material was faulty or the equipment was not properly constructed to perform this process. To determine the efficiency of the technic and equipment sold by one of the leading companies marketing this material, several dentures were made in vulcanite, the equipment and technic resembling as closely as possible those employed by this company, the only exception being that a temperature of 335 F. instead of 280 F. was used, as rubber does not vulcanize in the time given for processing the vinyl resins. The results were both interesting and instructive. In all cases wherein the denture was subjected to a temperature of 335 F. in the vault area, or in the center of the flask, it was in a semivulcanized state; while the periphery of the denture was burned to a crisp.

The experiments proved conclusively that it was impossible to process this material successfully with the equipment provided and the technic as outlined. Having learned of the inefficiency of the equipment, I decided to build an oven press, thermostatically controlled to as close range in temperature as possible. After a considerable investment of time and expense, this was perfected.

Again the experiments were conducted with vulcanite dentures as previously described, but with marked improvement. The dentures came out with a fairly well-vulcanized ridge and periphery, but with the palatal area either soft or in a semivulcanized state.

It is apparent that if a soft spot or semivulcanized area exists in a vulcanite denture, processed identically as are the vinyl resins, it is also certain that an uncured or unheated area will exist in a vinyl resin or any kind of a thermoplastic material similarly processed. Since the vulcanite dentures were only semivulcanized in the palatal area, the vinyl resins had a tendency to fracture through the palate, and the cellulose contracted and warped out of shape in the posterior portion when processed by the foregoing method. It thus became apparent that sufficient heat was not available to this area.

From the results of these experiments, I came to the conclusion that only through an all-metal mold could the internal strains of vinyl type resins or any thermoplastic material be successfully relieved, but to construct a mold that would be both practical and simple was beyond my ability at this time.

I made various sized heat conductors, shaped to contour the anterior and palatal portions of the denture, the ends resting on the metal of the flask in notches between its halves. Continued experiments gave me definite improvement over the past experimental cases, but the gain was not sufficient to warrant the continued use of the vinyl resins with the equipment thus far developed. Therefore, with my former conclusions regarding the proper method of processing thermoplastic in mind, I sought the means of constructing an all metal mold. The result, which I term the metal die technic, was a gratify-

ing justification of those former conclusions.

The equipment necessary when using this metal die procedure is altogether different from that used with other technics. In brief, the equipment consists of a flask, machined perfectly flat in the bottom; metal model cores; a horseshoe occlusal retainer, and a table or pedestal, also machined on the surface where the model is poured and shaped, and a ring with uprights, which form a waste gate and holds separator strips. There are also metal mount plates, recessed and machined on the under side to fit the top of the model core. This is an accurate method of attaching the models to and detaching from the articulator. The model core is drilled and tapped to receive a screw that passes through and attaches it to the bottom of the flask. This eliminates the necessity of mixing plaster, as well as providing a metal contact for better heat transmission to the denture.

After attachment of the waxed up denture to the first part of the flask as described, a coating of pure lead foil about seven or eight thousandths inch in thickness is applied to the surfaces similarly to the manner of applying tinfoil in the usual laboratory procedure. The lead foil is used instead of tinfoil because it has a higher fusing point and is thicker, thus withstanding the temperature and pressure of the molten metal when poured against it, as the waxed denture model immediately melts when the hot metal makes a contact with it.

When the foiling is complete, a lead horseshoe retainer is attached to the occlusal surface of the teeth with some good stone. This stone is wiped down over the gingival margins so that it will attach itself securely to the lead foil, a solid unit thus being made of the entire foiled denture. After the occlusal retainer is placed, a ring with uprights one-third of the distance apart is set in the flask around the foiled denture. These uprights are split and are spaced one at each heel and the third one at the anterior part of the denture. Through the slit in the upright, a piece of lead foil or asbestos sheet is fitted, one end being attached therein, and the other burnished against the denture and model in their respective places. These strips form separation points up to their heights, which, in most cases, will be even with the occlusal retainer.

After the separations are made, as described, the second or ring portion is placed in position. Three pointed screws are passed through the ring portion at relatively the same position as the lead separators. The screws are set down until the points engage the occlusal retainer just sufficiently to hold it against warpage, which might otherwise occur when the hot metal is poured into the flask.

The metal is now poured into the three sections formed by the separators up to the occlusal retainer. As soon as the metal sets, another thin piece of lead foil is burnished over the entire surface and the final pouring is done. The lid is then placed in position.

Wax elimination by boiling is not necessary as it has become liquid and most of it runs out by this time.

The flask should now be separated in the usual manner and the residue of wax washed out with acetone or some suitable solvent. As soon as the wax is eliminated, the model should be covered with thin tinfoil in the usual laboratory manner. The material to be used will determine how the next step is made. If it is a thermoplastic, the flask should be placed in the oven, which has been preheated, and allowed to set until the heat has reached the desired point. If it is vulcanite, the case will be found hot

enough to be packed most efficiently; in fact, so successfully that trial packing may be eliminated.

The remainder of the technic consists in curing, which is determined by the material and method used. In the case of rubber, in vulcanizing by dry heat, from twenty-three to thirty minutes at 335 F. is required; in using steam pressure, approximately three-fourths the time usual in curing with a plaster mold. In the case of thermoplastics, approximately fifteen to seventeen minutes is required to close the flask completely.

The reasons that dentures processed in an all metal mold are superior to those from plaster molds are thus readily recognized. First, and of greatest importance, the metal is much denser and therefore a better heat conductor. The relative heat-conducting value of metal as compared to plaster of Paris is approximately six to one, and in relation to that of silver, it is about 145 to 1,000. Also, it will hold or retain at a given temperature far more heat units than can possibly be forced into a nonconductor such as plaster of Paris. Too, it is superior because there is little compression under pressure, such as is invariably found in plaster. And in addition to the many advantages insured the denture by the all metal technic, it should be kept in mind that conditions often loosely diagnosed as stomatitis are avoided.

TREATMENT AND RESTORATION OF FRACTURED PERMANENT ANTERIOR TEETH*

By JOHN C. BRAUER, D.D.S., A.B., M.S., Lincoln, Nebr.

MANY mishaps in children's play, such as blows to the anterior part of the mouth, cause great concern not only to the parents but to the profession as well. Accidents involving the baseball, swing, rollerskates, football, drinking fountain and many other factors in the activities of youth bring the fractured anterior tooth to the office. The central and lateral incisors are affected most frequently because these teeth are most prominent. The cuspid is more bulky and, too, less often receives a direct blow. The bicuspids and molars, being farther back, are protected, but occasionally a severe blow fractures a posterior tooth.

A permanent central incisor is one of the most important teeth. It must not only serve as one of the organs of mastication, but also has an inestimable esthetic value. The loss of a tooth in the anterior part of the mouth, particularly if the boy or girl has well alined teeth, cannot be measured in dollars and cents. An unsatisfactory restoration of a fractured tooth often leads to a sense of inferiority, which may be a direct factor in the failures of that child in the future. A girl or boy aged 8 or 10 may be the future stage or screen star, or he or she may be the head of a large business firm. The late

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teens finds young people advancing rapidly in social life, where a maximum of esthetic values is necessary A boy or girl with an unsightly anterior restoration cannot have the same social ease, the same social possibilities as when no such handicap is present. It is our duty as guardians of dental health and comfort to be fully cognizant of all the possible considerations in fracture of the permanent anterior teeth. Parents should be fully informed as to their obligation regarding their child's future happiness.

Fig. 1.—Case of girl, aged 10, having coronal fracture in close proximity to pulp.

Fig. 2.—Case shown in Figure 1; two years later. A cemented band is in place. The tooth is vital and painless.

Fractures of the anterior teeth may be classified as (1) coronal fracture, with little, if any, dentin exposed; (2) coronal fracture with varying degrees of exposure of dentin; (3) coronal fracture with exposure of the pulp; (4) no coronal fracture, but apical, middle or cervical one-third root fracture; (5) coronal fracture with or without exposure of the pulp and root fracture, and (6) various types of fracture in devitalized anterior teeth. In addition, there is displacement of anterior teeth with no coronal or root fracture.

In case of a blow in the anterior part of the mouth, the first thing to determine is when the accident occurred. A brief case history is essential. The tooth or teeth are tested for sensitiveness to touch and thermal and electrical response, the degree of vitality, the mobility and occlusion of the tooth or teeth being thus determined. Many times, the tooth will not respond to thermal or electrical changes for a day after the accident, but will then give a normal or hypersensitive response. Regardless of the degree of

fracture in the coronal area, or if no coronal fracture is present, a roentgenogram is taken; for, in many instances, there will be a root-end fracture. The roentgen-ray examination will reveal the size of the pulp, its relation to the fracture and the development of the root.

Type 1, a coronal fracture with little, if any, dentin exposed, is best treated by removing any sharp edges with a stone or sandpaper disk and then applying a de-

Fig. 3.—Case of girl, aged 9½, whose central incisor had been fractured two and one half years previously. The tooth received no treatment and is vital.

Fig. 4.—Case of girl, aged 14, who had coronal fracture four and one half years previously. The tooth received no treatment and is vital.

sensitizer such as formalin or phenol. The majority of these cases do not need restoration. A test of vitality should be made from a week to ten days.

Type 2, coronal fractures with varying degrees of exposure of the dentin, but with no pulp exposure, are the most common cases. After the examination, the tooth is isolated and dried, and an application of any of the essential oils is made. An orthodontic band is next fitted to the tooth, a wider band material being used if needed. The band is cemented to the tooth, the exposed dentin being left free. The exposed dentinal area is now covered with zinc oxide and eugenol paste, or any medicinal paste, and cement is allowed to flow over the paste to fill the band. This should be left on for at least six months, and longer, if age and esthetics are not factors. Between the ages of 14 and 16, a permanent restoration can be made, with a gold inlay, a three-quarter crown with a synthetic porcelain window, a porcelain inlay or a porcelain jacket crown. The last is the most favorable as regards esthetics,

as well as for efficient service in mastication.

Figure 1 is a roentgenogram from the case of a girl, aged 10, who had a fracture of an anterior incisor, the result of a fall. The mesial horn is shown in close proximity to the line of fracture. Figure 2 is from the same case at the age of 12 with the band in place. The tooth responds normally to vitality tests and is painless.

Fig. 5.—Case of boy, aged 19, who had had coronal fracture ten years previously. There was no treatment and the tooth is vital.

Figure 3 is from the case of a girl, now aged 9½, whose central incisor was fractured two and a half years previously. No treatment was instituted, and today the tooth is painless and gives a normal response.

Figure 4 is from the case of a girl, now aged 14, who had this fracture four and a half years previously. No treatment was given and the tooth gives a normal vitality response.

Figure 5 is from the case of a boy aged 19 whose tooth was fractured ten years ago. It was not treated, and today it is normal in every way.

Figures 3-5 show considerable loss of tooth substance and exposure of the dentin not far from the pulp, but the teeth are still vital, healthy and useful, which

Fig. 6.—Case of woman, aged 26, who had had coronal fracture at age of 12. An inlay was placed with the advice that the tooth was devitalized and that it should be removed in the late teens. The tooth was found vital.

shows the remarkable power of accommodation of the pulp tissue. Age was possibly a factor in the situation, in that the root ends were not fully developed and there was a greater blood supply to the pulp. It is not recommended that such nontreatment be advised for patients. It is only logical that nature intended to

have a protective layer over the pulp, and, therefore, a sedative or medicinal paste with a covering of cement should be of value in the event of a fracture.

Figure 6 is from the case of a young woman, now aged 26, who had a fracture at the age of 12. The dentist told her that he believed the tooth to be "dead," but would put in an inlay. He advised her to have the tooth extracted in a few years. It is evident that the dentist thought the tooth devitalized from the

Type 3, coronal fracture with exposure of the pulp, warrants a more exacting treatment. There are those in the profession who immediately say "Extract," and then there are those who say "Let's try to save the tooth and preserve its vitality." It would seem logical that preservation of the vitality and retention of the tooth in the arch would be much better than any artificial restoration. Unfortunately, for various reasons, the fractured anterior cases are not always seen

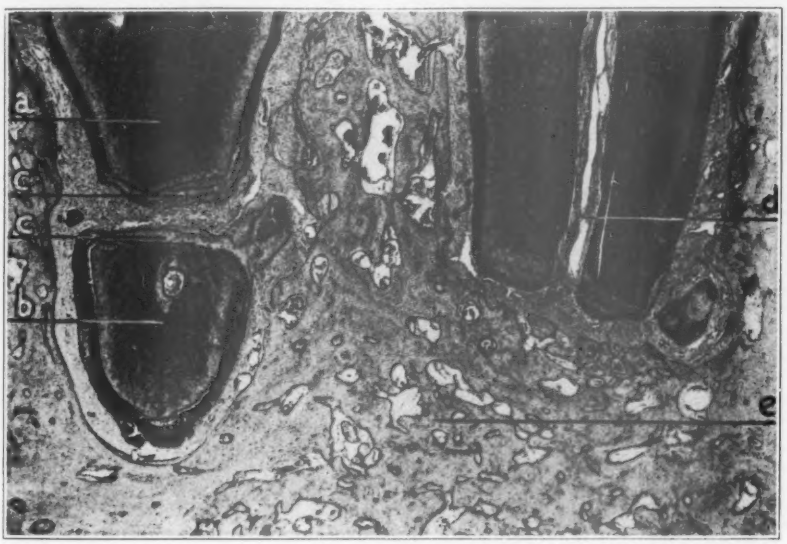

Fig. 7.—Case of woman, aged 45, who at age of 12 fell and injured anterior teeth. There was a positive response on use of the electric pulp tester. The right central fragment was displaced 3 or 4 mm. The left central apex is slightly separated. Development of secondary dentin is very evident. (Boulger.)

position of the posts. The patient came in to have the tooth removed and a bridge placed. On examination, the tooth looked normal, with no discoloration, and when tested for vitality, it responded normally. It is always well to have an adequate vitality record, and, too, to follow up each case.

immediately after the accident. The unprotected exposed pulp in such cases is subjected to thermal changes and infection, and the outcome of any treatment is questionable.

A child aged 7, 8 or 9 with an exposed pulp has a more favorable prognosis because the root end is still in the process of

development, and the pulp has a more abundant blood supply. The tooth should be isolated by means of a rubber dam, and all instruments, cotton and gauze should be thoroughly sterilized. If the exposure is slight, the portion of the pulp exposed may be touched with phenol, and a bit of sedative paste applied, over which is placed a sterile piece of platinum. A band, having been fitted, is cemented to place. If the exposure is extensive, the tooth is isolated, and, under a local anesthetic, a partial pulpectomy is performed. Burs, instruments, cotton and gauze should be sterile, and the tooth and adjacent rubber dam should be painted with iodine. A No. 4 or 5 round bur may be used to open the entire coronal pulp chamber, and a spoon excavator employed to remove the bulbous portion of the pulp. Hemorrhage may be stopped by applying a little phenol. Any blood clot must then be removed, and a sedative paste, such as sealer powder or zinc oxide and eugenol placed over the pulp stump. Cement can be placed over this and preparation can be made for a temporary restoration. If the pulp stump remains vital, the root end will continue to develop, this continued development being ample proof that no infection is present. The patient should return for observation and a vitality test in from ten to fifteen days, and thereafter every thirty days for some time. A permanent restoration similar to the one used in Type 2 is satisfactory.

If the patient comes in with a fractured anterior tooth, and the pulp has undergone putrescence, or, in the event

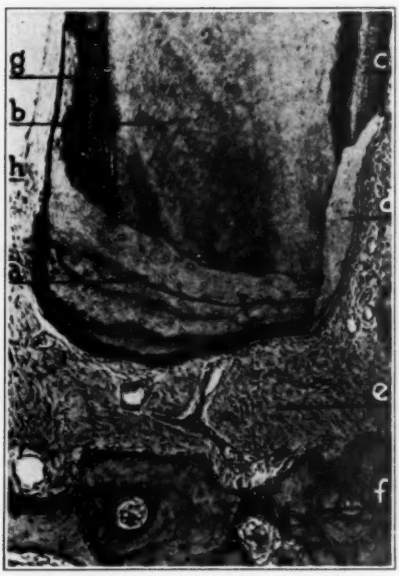

Fig. 8.—Higher magnification of Figure 7, right central root. (Boulger.)

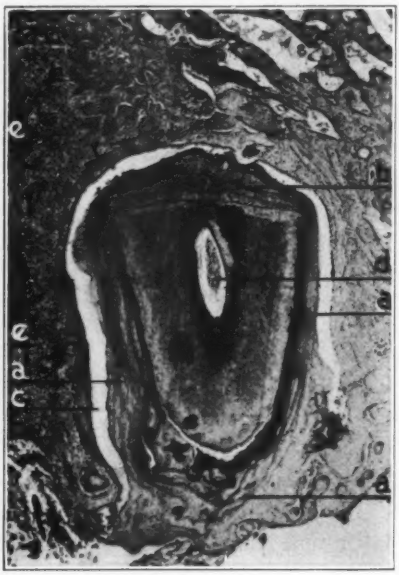

Fig. 9.—Root tip of right central incisor shown in Figures 7-9. The root tip is entirely walled off with cementum and is vital. (Boulger.)

of treatment, a vital pulp should undergo putrescence, extraction is advised, particularly if the root ends are not fully developed. A horseshoe plate or bands on adjacent incisors with Steel's facing are employed to supply the lost tooth.

One of the finest treatises on fractured anterior teeth was written by Walter C. McBride, director of the Children's Dentistry Section of the Detroit Clinic Club. The report was based on answers received from forty-five men interested in dentistry for children.[1]

Type 4 is an apical, middle or cervical

Fig. 10.—Case of fracture of cervical one third of root in person aged 35. The fracture occurred five years before the removal of the tooth, which was found united and vital. (Kronfeld and Ing.)

third root fracture, with no coronal fracture. Root fractures are not so common in the child 7-10 years of age, because the root is not fully developed and the tooth is not so stable. The early and late teens finds root fracture more common. Football, basketball, baseball, and boxing have their part in these various kinds of root fractures. It has been the consensus of opinion that in fracture of a tooth root, the prognosis was most unfavorable. That a root fracture does not always have an unfavorable prognosis has been very ably demonstrated by a number of men through their histologic findings. The works of Kronfeld,[2] Austin,[3] Gottlieb,[4] Boulger,[5] Ottolengui[6] and others show remarkable recovery and vitality of the pulp years after fracture.

Austin says:

> Only eighteen of the forty patients (thirty-one men and nine women) were able to give a history of the accident causing the fracture. The ages of the patients at the time of examination ranged from 12 to 63 years. The longest period that a fractured tooth had been retained was fifty-two years. There was a positive response to the vitality test in thirty-one cases and a negative response in nine. The color of all teeth that responded positively was normal. Some changes had taken place in the pulp canal in six teeth, and the remaining thirty-four were normal as compared with the neighboring teeth. There were four

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fractures in the apical third of the teeth, thirty-six fractures in the middle third and none in the cervical one-third. Two of the teeth fractured in the apical third were negative to the pulp test. . . . The line of fracture was transverse in thirty-eight teeth and diagonal in two. . . . The bone tissue surrounding the walls of the teeth was normal in thirty-two cases.[1]

Fig. 11.—Cross-section of tooth illustrated in Figure 10; showing secondary dentin and cementum. (Kronfeld and Ing.)

Fig. 12.—Higher magnification of Figure 11. (Kronfeld and Ing.)

Boulger reports a case of a woman, aged 45, who asserted that, at the age of 12 years, she fell down stairs and suffered an injury of the anterior teeth. The upper left incisor became sore and abscessed, and was removed four years later. It was disclosed in a roentgenogram thirty-three years later that the lower central incisors had been fractured. Examination revealed the fragment, which was removed from the right central incisor a considerable distance (3 or 4 mm.). The electric pulp tester obtained a positive response. Figure 7 shows the two lower central incisors, the left central with its apex slightly separated from it. The development of the secondary dentin is very evident on both roots. Figure 8 is a higher magnification of the fractured root end of the right central incisor, and figure 9 a higher magnification of the apex of the right central incisor.

Through the courtesy of Rudolf Kronfeld and John Y. Ing, the following report is presented. The fracture occurred five years before the removal of the tooth, the patient being then 35 years old. The fragments were firmly united and came apart only during the removal of the tooth. The pulp was vital in both fragments. Figure 10 shows the roentgenogram of the fractured lateral incisor. Figure 11 is a cross-section showing secondary dentin and cementum. Figure 12 is a higher magnification.

Fig. 13.—Case of boy, aged 16, whose central incisors were knocked lingually into end-to-end relationship. The teeth were pushed into position one hour later and a stabilizer prepared.

Figures 13-16 are from the case of a boy, aged 16, who, while boxing, had both central incisors knocked lingually so that he could close his teeth only end to end. About an hour after the accident, the two central incisors were pushed into position and a stabilizer was prepared. About a month and a half later, another roentgenogram was taken, resorption being noted at the apex. Three months after the accident, the third roentgenogram was taken. The teeth were firm and both responded to the vitality test. Jan. 14, 1936, approximately two years after the accident, the last roentgenogram was taken. Resorption had apparently ceased, and the teeth both responded to thermal and electrical tests. The two central incisors did not respond quite so quickly as the adjacent teeth.

Fig. 14.—Case shown in Figure 13; one and one half months later; showing root resorption.

Figures 17-18 are from the case of a boy, aged 17, who fractured a left central incisor in the cervical one-third during a basketball game. A stabilizer was placed two days after the accident. Four months later, the patient came in with the appliance off. The second roentgeno-

gram indicates an unfavorable prognosis. As there was no vitality response, the patient was advised to have the tooth removed.

Figures 19-20 are from the case of a youth, aged 20, who had a transverse fracture, Nov. 1, 1935, in the cervical one-third. The patient came in about a month after the accident, which occurred in a football game. The roentgenogram revealed some mesial bone destruction.

Fig. 15.—Case shown in Figures 13-14; three months after accident, when both central incisors responded to vitality tests and were firm in arch.

Fig. 16.—Case shown in Figures 13-15, Jan. 14, 1936, approximately two years after accident. The central incisors were firm and vital, showing no further resorption.

The tooth was vital but movable. The last roentgenogram was taken May 7, 1936, approximately six months after the fracture. The tooth is still somewhat loose, but it reacts the same as the adjacent central and lateral incisors to all vitality tests.

Figure 21 is from the case of another football player, aged 20, who fractured the upper left central incisor in the middle one-third in November, 1935. He would not wear a splint or stabilizer, and, May 12, 1936, he again struck this central incisor with his knee while going over a high hurdle. One hour after the accident, he came in with a loose tooth and was ready to have a stabilizer prepared. There was no response to vitality tests until the following day. The tooth was still vital and comfortable three weeks later. The patient has not been seen since.

Figure 22 is from the case of a man, aged 60, who, seven years previously, was in an automobile accident, but was not aware of any fracture in the mouth. In a routine roentgen-ray examination, the

two lower central incisors were found to be fractured, but both responded normally to vitality tests.

The factors in the success or failure of treatment of root-end fractures are governed by the vitality and resistance of the patient and the tooth, the extent of the fracture and the method of stabilization. If the tooth and pulp are normal and the fracture area is not exposed to the action of saliva or infection, the prognosis is quite favorable. Many times, an apical third fracture will not loosen the tooth, and then the stabilizer is not so important. If the line of fracture is close to the cervical one-third, the crown is usually quite loose, and unless it is stabilized, it will rarely become solid again. Fractured teeth also have the tendency to elongate; and thus the line of fracture often widens, complete union becoming impossible. It is therefore always best to prepare a stabilizer and immobilize the coronal fragment.

Kronfeld, in his excellent treatise on fractured anterior teeth, says:

Shortly after the accident, the hemorrhage that invariably takes place within the line of fracture will be resorbed or organized by ingrowing fibroblasts and cementoblasts. First a fibrous bridge will be formed between the fragments. Later on, cementum will be deposited along the line of fracture. If the root fragments are in close adaptation, they will be "cemented together" by the cementum and the continuity of the root thus restored. If the fractured extremities are farther apart, each will be covered over with cementum. Fibrous tissue will remain between, and

Fig. 17.—Case of boy, aged 17, with cervical one third root fracture. The stabilizer was placed two days after accident.

Fig. 18.—Case shown in Figure 17, four months later. The appliance was off and there was evidence of mesial resorption. The tooth was removed.

no union will take place (pseudo-arthrosis). Healing of this type may be entirely satisfactory for maintenance of function, provided the coronal fragment is long enough to insure sufficient periodontal attachment.[7]

Dr. Kronfeld also says:

The conditions for the healing of a root fracture are the same as for any simple bone fracture. They may be classified as follows:

1. The fragments must be in position of close adaptation.

Fig. 19.—Case of a boy, aged 20, with transverse fracture in cervical third of central incisor occurring Nov. 1, 1935. The patient came in for treatment one month after accident. The tooth was loose, but gave an excellent response to a vitality test.

2. The fragments must be immobilized in this position.

3. Absence of infection is necessary.

4. The patient's general health must be such as to make reparative and regenerative processes possible.

Type 5, coronal fracture with or without exposure of the pulp having a root fracture, is treated just as any other coronal fracture. In addition, the tooth is immobilized.

Type 6 embodies the various types of fracture in pulpless anterior teeth. If there is a root-end fracture in an infected pulpless tooth, the prognosis is most unfavorable, since healing will not take place in an area of infection. If there has been a root canal filling, and the root and canal are free from infection, the prognosis is quite favorable, in that cementoblasts or fibroblasts will unite the fractured parts.

Fig. 20.—Case shown in Figure 19; May 7, 1936, with tooth slightly movable and no differential response to vitality tests between it and adjacent teeth.

Type 7 is not a fracture of the coronal

7. Kronfeld, Rudolf: Histopathology of Teeth and Their Surrounding Structures, Philadelphia: Lea and Febiger, 1933.

or root area, but a displacement of an anterior tooth. Figure 13, previously discussed in this paper, shows an example of this type. Figure 23 is from the case of a football player whose upper left central incisor was displaced March 13, 1936. The tooth was pushed back into place by him, and he came in for treatment, April 20, 1936. The roentgenogram revealed a large area of bone destruction mesially. The tooth was turning dark and the vitality test was negative. Extraction was advised.

Fig. 21.—Case of youth, aged 20, with fracture of upper left central incisor, middle third, occurring November 1935. The patient would not wear a stabilizer. May 12, 1936, he received another blow on this tooth, which gave no response to vitality tests for twenty-four hours, but regained its vitality. A stabilizer was placed and the tooth responded to tests three weeks later.

An important diagnostic symptom of the death of the pulp is the discoloration of the tooth. In discoloration, the pulp tissue disintegrates, and the blood pigment is set free and absorbed by the dentin.

CONCLUSIONS

Health, esthetic requirements and the masticatory efficiency of the permanent anterior teeth warrant their careful treatment in the event of fracture. A blow in the anterior part of the mouth receiving no treatment by a dentist at the time of the accident many times terminates in periapical infection and bone destruction. Improper restoration or lack of any restoration in fracture of the anterior teeth often leads to a sense of inferiority and the feeling that one is a social misfit.

Fig. 22.—Case of man, aged 60 years, who had both central incisors fractured in apical third seven years previously. The teeth are vital and firm and no treatment had been given.

That fractured crowns, with or without pulp exposure, can be successfully treated has been demonstrated by many. That fractured roots not exposed to the saliva or an infected area can maintain vitality has also been demonstrated. A brief case history, a roentgen-ray examination to determine the extent of the coronal fracture and possible root fracture, the protection of the exposed dentin or pulp, the stabilization of the coronal area in root fracture and a systematic following up of the case are the considerations in every fracture of a permanent incisor. The age and the health of the patient, as well as the health of the tooth, the extent of the fracture and the type of restoration, are all factors in the success or failure of the treatment.

Fig. 23.—Upper left central incisor, which was partially displaced March 13, 1936, and was put in position by patient immediately after accident. Treatment was sought April 20, 1936. The tooth had turned dark, and gave no response to vitality tests, and therefore was removed.

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TOOTH ARRANGEMENT IN COMPLETE DENTURE PROSTHESIS*

By R. O. SCHLOSSER, D.D.S., F.A.C.D., Chicago, Ill.

THE technic to be described is that taught by me in the clinical laboratories of Northwestern University Dental School. In part, it is based upon a study of prosthetic articulation as portrayed in the writings of Gysi, Prothero, Trench and Hanau, and in part upon my own experiments and observations during the past eighteen years.

While the technic is used in conjunction with the Hanau model H articulator, it may be employed with any of the modern occluding frames that permit a simulation of mandibular movements. It is assumed that all necessary preceding steps have been properly executed, up to and including the restoration of lost facial dimensions and contour, the registration of positional relations and the mounting upon the articulator of casts that permitted establishment of an acceptable denture space.

The maxillary anterior teeth are set to form the anterior section of the occlusion contour rim, preparatory to use of the baseplates with attached rims for restoration of the lost facial dimensions. This tentative setting obviates the marking of the high and low lip line, the line of the commissure and the line denoting the proper position for the disto-approximal surface of the maxillary cuspids. Tentative as this setting is, it serves remarkably well as a position of reference, and any modification of arrangement that may subsequently be required will consume no more time than most operators ordinarily use in modifying wax or modeling compound contour rims and marking the various lines referred to previously.

Figure 1 illustrates the prepared baseplates with mounting casts.

After the restoration and registration of positional relations and the mounting of the casts, the setting of the maxillary anterior teeth is carefully checked and, if need be, they are rearranged, preferably three at a time, the teeth on the opposite side remaining as a guide until the first three have been reset. The following points are to receive particular attention at this stage: the median line, the positions and alinement of the incisal edges and of the axial alinement in relation to the esthetic and phonetic requirements. As these modifying changes are executed, it is advisable to note the ridge relation as shown on the articulator mounting and to incorporate, in setting up, the proper amount of overjet. After this rearrangement, the baseplates should again be inserted and the patient be given an opportunity to view the restoration. The patient may then be dismissed and the rest of the teeth set at the operator's convenience; or the work may be delegated to a technician.

A procedure that I often use is to rapidly set the remaining teeth, employing

*Read before the Section on Full Denture Prosthesis at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 14, 1936.

for this purpose the ordinary black carding or boxing wax. This rarely consumes more than from ten to fifteen minutes and, after chilling, a tentative trying in may be carried out. This permits a fairly good checking up of the tooth arrangement, as to the requirement of appearance and speech, especially of the maxillary denture. If found acceptable, the maxillary denture can be completed, and a second trying in can be carried out while the mandibular denture is still in the wax model stage. At such a time, errors that may be due to faulty registration, to changes occurring during vulcanization or curing or other conditions may be corrected by the resetting of the mandibular teeth, and thus these ever-present hazards can be reduced. For the past two years, we have made the completion of the maxillary denture and a

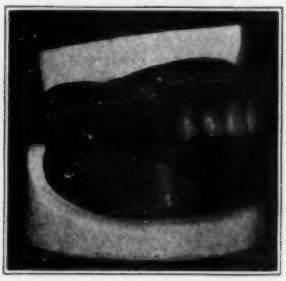

Fig. 1.—Baseplate as prepared for registering restoration of last facial dimensions.

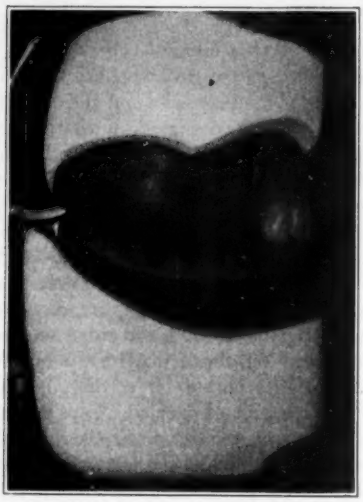

Fig. 2.—Case mounted with centric record.

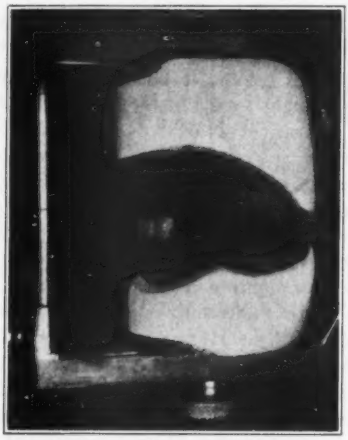

Fig. 3.—Mounted case with protrusive record.

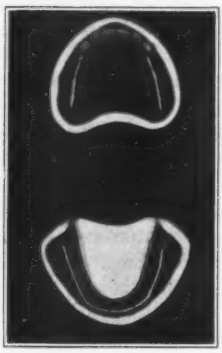

Fig. 4.—Baseplates with lines over ridge crests.

second trying in of the mandibular wax model a clinic routine. This has reduced very materially the need of making over. For the undergraduate, we do not advise the above-mentioned optional procedure unless the instructors are able to aid the student in a speedy setting up. For the general practitioner, we believe that it is a great saver of time and effort.

LABORATORY STEPS IN SETTING UP TEETH

As previously stated, the case has been mounted and the tentative setting of the anterior teeth has either been modified or the changes that are to be made have been carefully noted. Figure 2 shows the case mounted on the articulator.

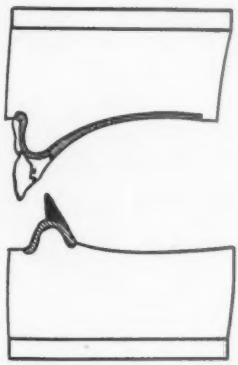

Fig. 5.—Sagittal cross-section of mandibular wax core.

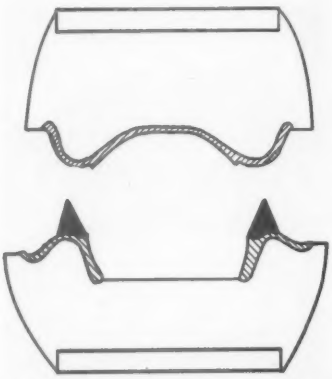

Fig. 6.—Frontal cross-section of mandibular wax core.

The patient having been excused, the case is now taken to the laboratory, where the setting up is to be completed before the patient is recalled for the trying in. The condylar indications registered are recorded on the articulator; the extent of the labial overjet is noted; the wax or modeling compound rims are removed from the baseplates, and the planned changes in the arrangements of the maxillary anterior teeth are either made at this time, or, if already made, they are once more checked.

Primarily, these teeth were set in compliance with the esthetic requirements; and in order that they may best meet the functional requirements, certain other basic principles of technic should be followed; i.e., being units of the anterior segment of the maxillary arch, they should be set in alinement with the arch curvature, as observed from a properly molded baseplate; the anterior teeth, which are also recognized as separate units of a single cusp, should be checked as to their arrangement for conformation to this principle, and, lastly, whenever possible, there should be relative symmetry between the lateral halves.

The mandibular anterior teeth are set in a like manner as units of the arch and cusp formation, the recorded condylar guidance is observed and the incisal guidance is set in compliance with the laws of articulation.[1] The procedure of setting the mandibular anterior teeth and

1. Prothero, J. H.: Prosthetic Dentistry, Ed. 4, Chicago: Medical-Dental Publishing Co., 1928, p. 766.

all of the posterior teeth can be very much simplified by first modeling the remainder of the teeth as set up in a softer wax than that generally used, for a reason analogous to the one for the use of modeling clay by sculptors. I have used this method for several years, and I described a somewhat similar technic in a paper read before the First District Dental Society of New York in 1927, a year later incorporating it in my contribution to the revision of Prothero's "Prosthetic Dentistry."

The first step in this procedure is to form some of the black carding or boxing wax into a core the shape of a right angle triangle, by molding it with the fingers, and to place it on the baseplate as shown in Figures 5 and 6.

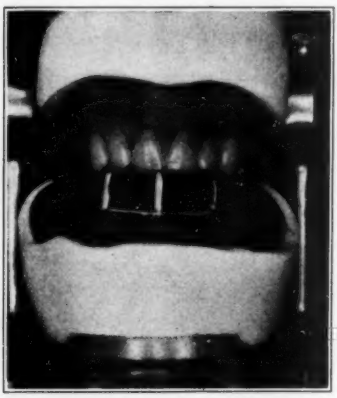

Fig. 7.—Median and cuspid lines on wax core.

Care should be taken not to cover the labial or buccal surfaces of the baseplate. This core extends upward approximately halfway toward the maxillary baseplate, its crest being parallel to the crest of the ridge. Thus shaped, this core furnishes an excellent index or aid in developing the arch form and the compensating curves.

The second step is the marking of lines on the labial surface of the wax core base directly below the maxillary median line; and while the mandibular jaw member of the articulator is held in a lateral relation equal to half the width of the lower central incisor, a line is marked just below the point of the maxillary cuspid, the line on the left side being marked while the articulator jaws are held in the left lateral relation, and on the right side when the jaws are in right lateral relation. (Figs. 7 and 8.)

The actual setting of the teeth is begun by placing the mandibular cuspid with its distoproximal aspect to the line, alining its distal half with the posterior segment of the crest of the wax core, its mesial half with the anterior portion of the crest, giving the distal half a slight lingual inclination and the mesial half a slight labial one. The articulator jaws are now closed and the setting is checked for freedom from interference in centric occlusion and for proper contact in the working lateral relation with the disto-incisal

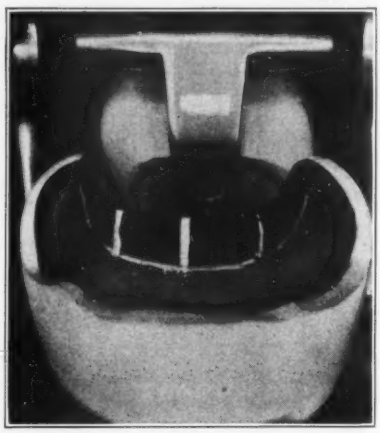

Fig. 8.—Mandibular wax core ready to receive teeth.

angle of the maxillary lateral and the mesial slope of the maxillary cuspid. The next tooth to be placed is the mandibular first bicuspid, the mesioclusal angle of which should be set to line up with the distoincisal angle of the cuspid, its long axis inclined lingually and the crest of its buccal cusp, as those of all the mandibular posterior teeth, in vertical alinement with the ridge crest. Its mesial slope should be in good occlusion with the disto-incisal slope of the maxillary cuspid in centric occlusion and in working lateral relation, as shown in Figures 9-11. Lastly, it should offer no interference during protrusive excursions.

This setting, which thus completes the

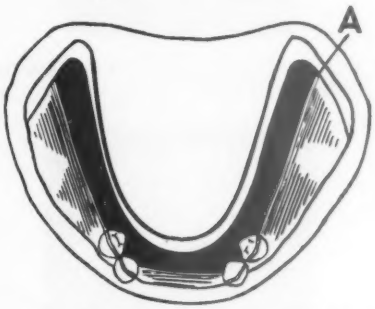

Fig. 9.—First step in arrangement of mandibular teeth. *A*, position of ridge crest.

articulation of the cuspids, I consider to constitute the major key in the articulation of all teeth in complete denture prosthetics.

The central incisors are next set to the median line as marked and so placed that the amount of overjet previously determined is reproduced. In the vertical plane, the incisal edges are so placed that the resultant overbite or cusp height will permit the making of proper incising contacts without interference. Mesiodistally these, as well as the edges of the lateral incisors and the mesial half of the cuspids should be in parallel alinement with the ridge crest; while, at the cervical portion, these teeth should be slightly depressed in order to have a moderate labial inclination. The placing of the lateral incisors in the remaining space completes the setting of the anterior teeth. This is not always a simple task, because of the variations often encountered in ridge relations and the accompanying facial profiles.

For the normal or Class 1 cases, it is merely a matter of alining the lateral incisor with the distal edge of the central incisor and the mesial aspect of the cuspid and checking the articulation for compliance with the mechanical requirements

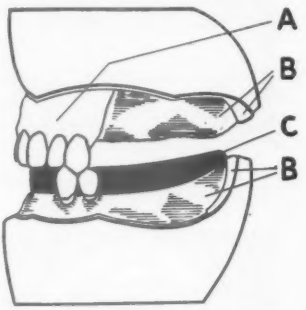

Fig. 10.—Cuspids articulated (major step of setting up). *A*, pink wax. *B*, vulcanite baseplate. *C*, black carding wax.

by moving the mandibular jaw member of the articulator from centric relation to the protrusive and lateral positions within functional range and back again to centric position. For the cases with protracted mandibles, it is, at times, necessary to retract the anterior segment of the mandibular arch somewhat lingually from the crest of the ridge and to place the corresponding segment of the maxillary arch as far labially as esthetic values will allow. These cases will be further simplified by employing a minimum over-

jet and overbite; and by arranging the mesial aspect of the lateral incisors to overlap the distal aspect of the central incisors, it is possible to obtain a more nearly perfect cuspid articulation, as well as to give the set-up teeth a less artificial appearance.

The placing of the mandibular cuspids and first bicuspids in articulation with their maxillary opponents can then be carried out in the regular manner. A study of the space between the cuspids will determine just how many teeth can be accommodated and in what manner they are to be placed to best meet the esthetic and functional requirements. In the moderately retrusive case, a setting of the incisors in slight torsional version will suffice; while in the more extensively retruded cases, a reduction of mesioproximal contact points by grinding with small stones on the lateral incisors and cuspids will allow these teeth to be set closer to the distal aspect of the central and lateral incisors. With this torsional setting, very pleasing results are obtained. In the extreme cases, it will be necessary to omit a central incisor, and in the exceptionally severe cases, both central incisors may have to be eliminated. Certain operators

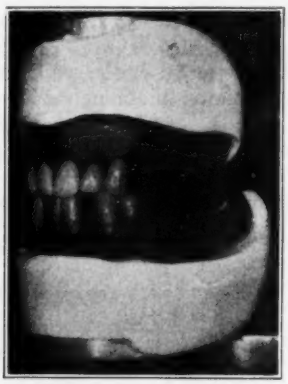

Fig. 11.—Central incisors set to required overjet and overbite.

Fig. 12.—Occlusal view; showing alinement of teeth with ridge crest.

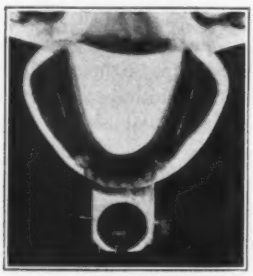

Fig. 13.—Occlusal view after setting of first mandibular bicuspid.

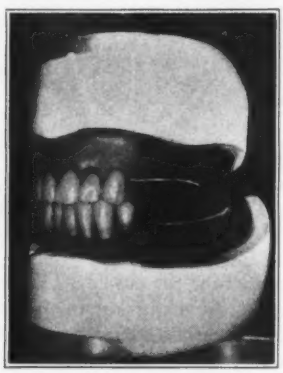

Fig. 14.—Setting of anterior teeth with completed cuspid articulation.

substitute teeth of lesser mesiodistal dimensions in cases of this nature. It is my opinion that the contrast in size produces a less desirable effect than the omission of a single tooth. Another alternative would be to substitute maxillary teeth of greater mesiodistal dimensions; but this would again produce a very apparent size contrast, and when the teeth originally selected were judged correct for the case, it would be best to retain them.

The variations in arrangement referred to and the operator's judgment should enable him to obtain favorable results in even the most difficult cases. Naturally, the man with artistic ability will deviate from any so-called standard technic. This text is not to supplant individual conceptions, nor to eliminate the use of preextraction records, such as photographs or casts of the natural dentition, whenever these can be procured. It should also be realized that there may result a difference in ridge relations between the dentulous and the edentulous jaws and that such variations will increase progressively as resorption of the ridges becomes more pronounced. The ideal to be striven for, regardless of the degree of change that the ridges have undergone, is the most pleasing result, from the point of view of esthetics and the most efficient one on the basis of compliance with the functional requirements. We know, of course, that this ideal can only rarely, if ever, be achieved and, in consequence, compromises in the most favorable direction must be resorted to.

Before considering the arrangement of the bicuspids and molars, I shall briefly summarize the steps covered thus far:

1. The maxillary incisors and cuspids were set in compliance with the esthetic and phonetic requirements, as units of the anterior segment of, and in harmony with, the arch form. In their assembly, they were also treated as units of a single cusp form.

2. The mandibular anteriors were in turn set in like manner to conform to the arch and cusp formation; and, coordinately with their setting, the desired overjet and overbite or anterior cusp height was incorporated in accordance with the laws of articulation; which infers that they were also set in compli-

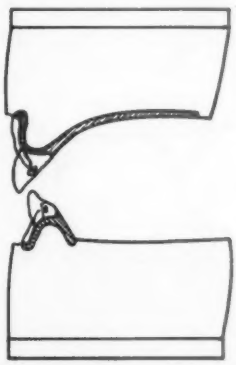

Fig. 15.—Sagittal view of incisors Class 1 ridge relation.

Fig. 16.—Sagittal view of incisal articulation for Class 2 ridge relation.

ance with the mechanical requirements.

3. In addition to the setting of the anterior teeth, the first mandibular bicuspids were also set to complete the articulation of the cuspids. This step, as should be observed, is the first one in the working out of the interdigitation, and it materially simplifies the setting of all the remaining teeth.

SETTING OF BICUSPIDS AND MOLARS

In the past, the development of planes of occlusion and compensating curves on rims of wax or modeling compound attached to baseplates has consumed a considerable amount of the operator's time. There have been various methods of establishing planes of occlusion parallel to the alae tragus line. These planes were subsequently modified by the molding and trimming of the rims after the case was mounted on the articulator, in an effort to determine the inclination of the compensating curves. Another method is to have the curves ground in by the patient, modifying the rims by the addition of plaster of Paris and abrasives. The objectives in the minds of these operators were basically the same as those that we have in mind today, and it is not the intention here to criticize the technic of our predecessors, but rather to present a method that will permit the attainment of the same objectives in a much simpler and less time-consuming manner. The prime essential in the technic that I employ is the practical application of the laws of articulation as formulated and presented by R. L. Hanau in a paper read at the annual session of the American Dental Association in 1925.[2]

As stated by Hanau, the five most important factors in arranging artificial teeth in balanced articulation are (1) the inclination of the condylar guidance; (2) the prominence of the compensating curve; (3) the inclination of the plane of orientation; (4) the inclination of the incisal guidance, and (5) the heights of the cusps. These factors have been clearly defined in the original text. This information also appears in the fifth and sixth editions of Turner and Anthony's

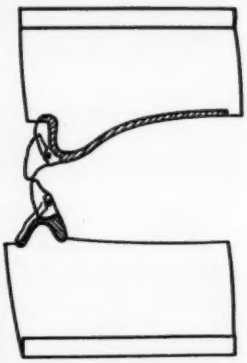

Fig. 17.—Sagittal view of incisal articulation for Class 3 ridge relation.

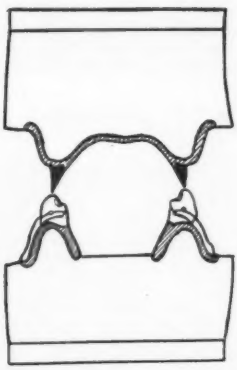

Fig. 18.—Frontal cross-section of maxillary wax core in bicuspid region.

2. Hanau, Rudolph: Articulation, Defined, Analyzed and Formulated, J.A.D.A., 13:1694 (Dec.) 1926.

"American Text Book of Prosthetic Dentistry." With the exception of the plane of orientation, these phrases have been in common usage for a sufficient time to insure ready comprehension. I submit my personal definition of the plane of orientation:

The plane of orientation—when this

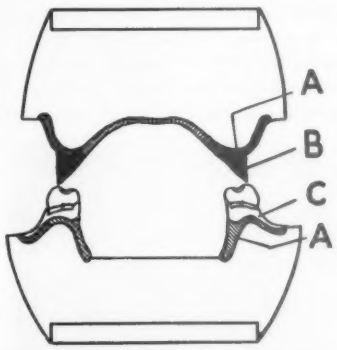

Fig. 19.—Frontal cross-section of maxillary wax core in molar region.

Fig. 20.—Mandibular set-up after checking of inclination of plane of orientation and compensating curve.

term is used in complete denture prosthesis—may be defined as a plane within the denture space. This space is determined or established by the proper mounting of the cases upon the articulator. The plane derives its inclination from the positions of three widely spaced contact points developed during the setting of the teeth. The anterior point results from the articulation of the in-

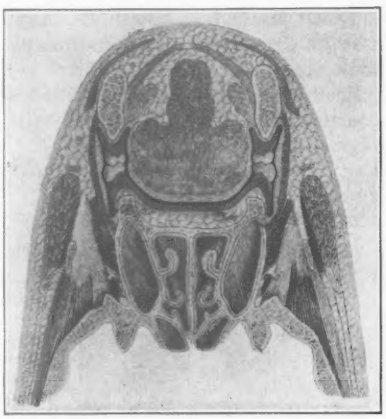

Fig. 21.—Frontal cross-section of complete dentures in situ showing relation of teeth to crest of alveolar ridges.

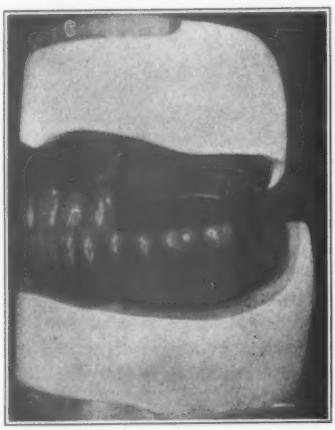

Fig. 22.—Sagittal view of maxillary wax core in occlusion.

cisors; the other two points are the most distal contacts resulting from the articu-

lation of the second molars. "The plane may be assumed to pass through the maxillary or mandibular points." The molar contact point positions will be influenced by the variation of the form of the ridges and their relation, as also by the magnitude of the denture space in this particular region.

For further details relative to the laws of articulation, I again refer you to the original text.

SETTING OF MANDIBULAR POSTERIOR TEETH

In setting the mandibular posterior teeth, we develop the posterior segments

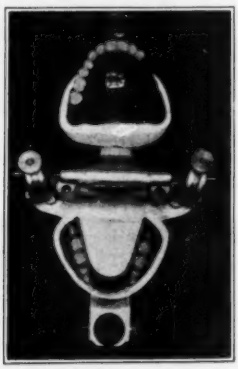

Fig. 23.—Occlusal view of right maxillary posterior teeth; wax core showing print of mandibular cusps.

of the arch, and tentatively work out the inclination of the plane of orientation and the compensating curves. In actual practice, much less time is consumed in setting the teeth than it takes to describe the procedure.

The arch form is completed by alining the crests of all buccal cusps with the crest of the wax core previously molded to parallel the crest of the alveolar ridge in the frontal plane. Thus, the position of the occlusal surface of the second molar is raised or lowered as may be required to permit the placing of the maxillary second molar. This tentatively determines the inclination of the plane of orientation. Next, the curve in the sagittal plane is checked and, if need be, modified until it is relatively parallel with the inclination of the condyle guidance. Lastly, the long axes are given a sufficient lingual inclination to develop the lateral compensating curves. This setting gives full consideration to the spatial requirements of the tongue and buccal vestibule and places the lower half of the masticatory

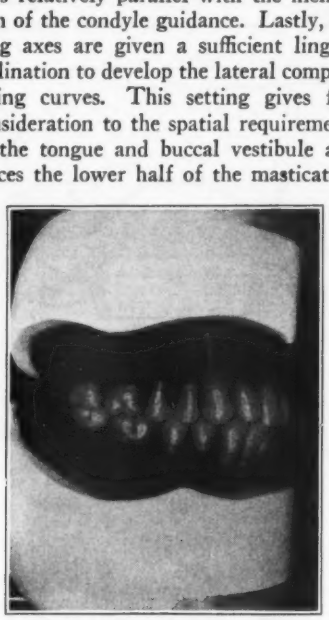

Fig. 24.—Sagittal view of set-up in centric occlusion.

groove lingually from the ridge crest, thus minimizing unfavorable leverages during mastication.

At the operator's option, he may complete the articulation on the right or left side before setting the mandibular teeth on the opposite side; or he can first set all mandibular teeth on both sides. The latter procedure permits a check-up as to the symmetry of the lateral halves of the mandibular arch, as well as the inclination of the plane of orientation and the curves in the frontal and sagittal planes.

In the setting of the maxillary bicuspids and molars, the first step is the molding and placing of the black wax core on the baseplate in such a manner as to leave the buccal surface of the ridge fully exposed. The crest of the core should be extended downward, so that, when the articulator is closed, the crest of the wax core will occlude with the tips of the buccal cusps of the mandibular teeth, as shown in Figure 22.

The first bicuspid is now placed in position on the wax core, so that the center of the masticatory groove lines up mesially with the distolingual aspect of the maxillary cuspid and distally with the print of the mandibular cusps as shown on the wax crest.

Its occlusal surface is allowed to extend somewhat lower than the tip of the maxillary cuspid, the opposing teeth being permitted to complete the setting as the articular jaws are closed in centric relation. The occlusion is next checked in working lateral relation and the setting modified, if need be, to perfect the interdigitation. No contact is required in the bicuspid region on the balancing side. In protrusion, the tips of the bicuspids should offer no cusp interference. The second bicuspid is next set in a similar manner and checked in the centric and working lateral relation for occlusion and against interference in the protrusive movement. The first molar is set, occluded and checked in a like manner.

Lastly, the second molar is positioned. While this tooth is occluded and checked in the same fashion, it is the one tooth that should be in occlusion in the balancing lateral relation as well as in the protrusive relation. When this tooth has been placed, the mandibular member of the articulator is repeatedly moved from the centric to the right and left lateral, as well as the protrusive relation, while the articulation of the teeth is scrutinized. Proper compensating curves have been established when observation discloses that all teeth are correctly occluded, without perceptible interference during mandibular excursions.

Fig. 25.—Sagittal view of set-up in left lateral occlusion.

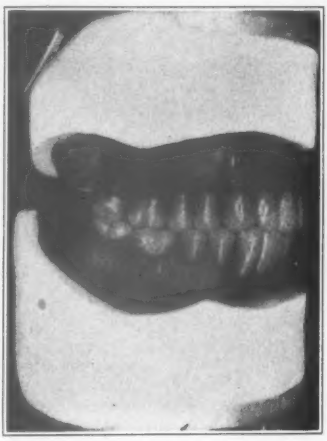

Fig. 26.—Sagittal view of set-up in right lateral occlusion.

The specific advantage of arranging the initial set-up in soft black carding wax is not only that it can be done rapidly, but also that any needed changes in arrangement can be easily made and, at the operator's option, the case can be tried in before much time or effort has been expended. This is particularly true as regards the maxillary denture, as has been stated previously.

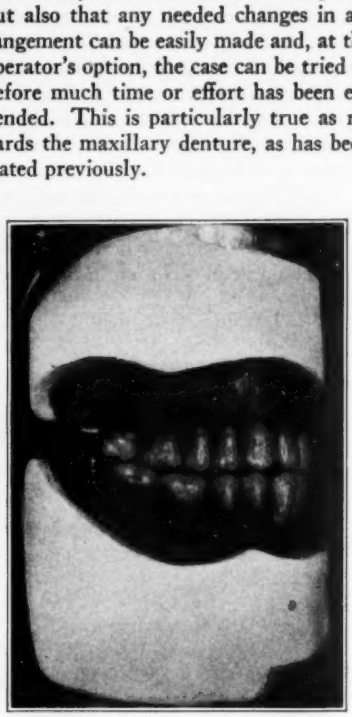

Fig. 27.—Sagittal view of set-up in protrusive occlusion.

REPRODUCING THE SET-UP IN THE HARDER PINK WAX

After the set-up has been judged acceptable, the resetting of the mandibular anterior and all of the posterior teeth can be most effectively accomplished by resetting in sections. Dividing the anterior segment in two, we have six sections.

Procedure.—The teeth to be first reset are removed from the baseplate with the section of black wax holding them, and teeth and baseplate are thoroughly cleaned of black wax and dried. Each tooth is reset in its respective position separately by first fitting it with a cone of softened pink wax large enough to support it when set and to help in developing the labial, lingual and buccal contours of the alveolar portion of the dentures. The remaining segments guide the operator in reproducing the arch form, overjet and overbite, compensating curves and occlusion as these were previously worked out. After the teeth of one section have been reset, the wax about them should be luted or melted onto them and to the baseplate.

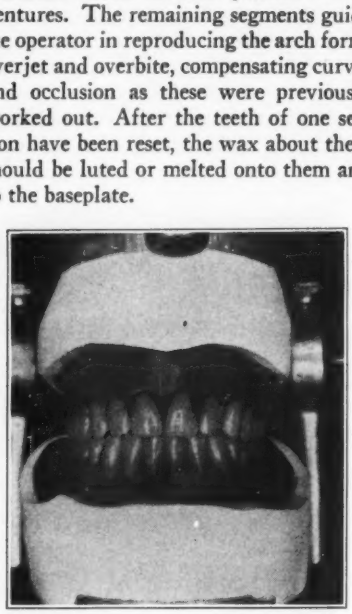

Fig. 28.—Frontal view of set-up after partial resetting.

It matters little which section is reset first, as long as due care is exercised not to disturb the other segments. It must be remembered that while the black wax is sufficiently resistant to hold the teeth in their position, its use will not insure them against being forced out of place by carelessness.

Whenever it is possible to improve the articulation during the resetting, this should always be done. It is not advisable to expend unlimited time in an effort to attain an absolutely flawless result, be-

cause the ultimate milling-in with abrasive paste now so generally practiced will serve to transform an approximately perfect into a perfectly balanced articulation. The case is now ready to be waxed up preparatory to the carving of the gum festoons. If, as a result of a tentative trying in with the black wax set-up, it is planned to complete the maxillary denture first, the festoons are carved on this denture and a remounting record made preparatory to vulcanizing, or curing. In making this record, a minimum of wax should be used.

The maxillary cast to which the den-

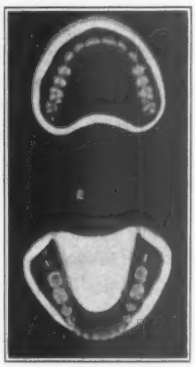

Fig. 29.—Occlusal view; showing alinement with ridge crest.

ture has been waxed is now separated from its mounting; or, in cases wherein vulcanite bases have been employed, the denture is boxed in, somewhat like an impression, and a new cast is poured into the denture in the material of preference (coecal, castone plaster or any of the quick setting artificial stones). When the cast has hardened, the boxing wax is stripped off. If the denture is to be made in vulcanite, the routine procedure of investing, packing, vulcanizing and polishing is carried out. When other materials are used, the technic specified for these materials is to be faithfully followed. When the dentures are thus far completed, the undercuts are to be filled with soft wax and the denture is to be replaced on the mounting record and attached to its original mounting with plaster of Paris. The wax record is now removed and the articulation is again checked. If any disturbances are evident, the occlusion is corrected before the patient is recalled for a second trying in.

Second Trying In.—As previously stated, this is carried out after the maxillary denture has been completely processed in the laboratory and remounted on the articulator. Its primary purpose is to permit a further checkup on the registration of jaw relations, articulation of the teeth, esthetics and phonation while the opportunity still exists to make needed corrections by the simple process of rearranging the mandibular teeth. It is of particular advantage in those cases where the initial trying in was made with the rapidly developed black wax set-up, but is equally valuable in all cases in which the less rigid and well fitting temporary baseplates have been used for the maxillary denture.

Procedure.—The completed maxillary denture is seated firmly and, after it has been in the mouth a few minutes, is checked for stability and retention. Next, the mandibular model denture is similarly placed and the patient is asked to bring the teeth into occlusion and to apply moderate biting pressure, as well as to contract the lips and cheeks in an effort to more firmly seat the dentures. The first objective is to ascertain whether, as the patient closes the jaws in centric relation, the teeth are brought into centric occlusion and are in bilateral balance. The first can be determined by visual examination, the second can be more effectively interpreted by the patient with the aid of a well-balanced rec-

ord of centric relation made on the articulator. If the resultant observations reveal no error, an articulator record of the protrusive relation is made, the dentures are again placed in the mouth and the patient is asked to state whether the contact is uniform and whether he can apply biting pressure without discomfort. If so, the registrations as incorporated in the articulator mountings are judged acceptable and the trying in proceeds to the checking up of the denture space in its relation to face length and profile, and the tooth arrangement in its relation to appearance and speech and general comfort of the patient. Were we as operators ever so efficient, were our equipment the acme of mechanical perfection and our patients ever so intelligent, we would still be forced on occasion to admit that, in complete denture prosthesis, the biologic factor cannot be ignored. The point I am desirous of making is that, in spite of the many advances that have been made in clinical and laboratory procedures and the improvements in articulators and forms of artificial teeth, success in constructing prosthetic dentures will still largely depend on how well we understand the behavior of the human masticatory mechanism; and especially is this true as it applies to the deviation from normal functional behavior of the partially or completely edentulous jaws.

My observations along this line have convinced me that the mandible becomes more or less habitually fixed to abnormal positions and movements, and, as a result of these disturbances and fixed habits, a marked resistance is encountered to every attempt forcibly to restore forthwith the normal position and functional movements of the mandible. I have noted that the return to normal often begins as soon as the impressions for the dentures are started, particularly if occlusion rims are used on the trays and continue indefinitely as the work progresses, and the dentures are inserted, and for considerable period beyond. I consider this one of the prime factors in the failure correctly to register centric relation in many cases and, at the same time, one of the main reasons for advocating the placing of immediate dentures. The graphic registration of mandibular movements will, to some extent, aid in getting better records of positional relations, but are far from an undisputable means of assuring against failure. We shall now consider the technical procedure to be employed when checking up discloses an error in positional relation at the time of the trying in.

The first evidence that the previous registration was incorrect is the fact that, on inspection of the occlusion of the teeth, they are seen to be in retrusive relation to the maxilla; which usually indicates that a protrusion of the mandible was accepted in place of centric relation. It is not to be assumed that all such errors can be attributed to habits that the patient may have formed: there are a number of other probable causes, such as displacement of the baseplates during previous registrations, either because of poor adaptation to the casts or compression of the supporting mucosa on account of excessive or unevenly applied pressure at the time the registrations were being made. Lastly, it may be that an incorrect positioning of the bases was caused by the use of an adhesive preparation such as gum tragacanth. It is also possible that, in the processing of the maxillary denture, the flask was not properly closed. No matter what was responsible, there is but one course to follow: new records must be obtained and the mandibular cast must be remounted and the condylar guide indication reset. These are the hazards which, as I said earlier we can reduce materially by a second trying in.

Before taking new records, it is well to note whether the retrusion of the mandibular teeth has materially increased the vertical dimension of the denture space. If so, it is better to remove the bicuspids and molars from their wax sockets. A small amount of softened pink wax is then placed over these sockets, and a new registration of centric relation with the acceptable vertical dimensions of the denture space should aid the operator in evaluating this new record. After the mandibular cast has been remounted, a new record of the protrusive relation is obtained, and is used for resetting the condylar guide indication. The teeth are now reset and the trying in completed as previously outlined. It seems proper at this time to call attention to the fact that as the teeth of the maxillary denture are permanently fixed, it is not planned to disturb their arrangement, but rather, with the acceptance of the inclination of the plane of orientation and the compensating curves and the new setting of the condylar guidance as fixed, we must complete the articulation by such modification of the incisal guidance and overbite or cusp height as will establish the required overjet and balanced contacts. Here, as in any case wherein but a single denture is being made to occlude with one previously constructed, it is advisable to articulate the teeth by setting the second molars first and seeing to it that these teeth make proper contacts in all primary positions, then progressively set the first molar, the second and the first bicuspid, the cuspid and lateral and central incisors, determining or modifying the amount of overbite so that it will function coordinately with the compensating curve as worked out in the articulation of the posterior teeth. Should difficulty be encountered in occluding the second molars, the inclination of the incisal guidance should be decreased until the teeth show satisfactory contact in the right and left lateral and the protrusive relation. When such a modification of the incisal guidance does not suffice to permit the development of the necessary contacts, the cusp height of the molars may be increased by deepening the longitudinal and transverse grooves. The resetting should not consume very much time and, at the operator's desire, may be done at the same sitting or subsequently. Finally, the patient should be given an ample opportunity to view the set-up and test it for phonation so that any further correction can be made before the mandibular denture is put through the finishing processes.

I am fully cognizant of the fact that many men delegate the setting of teeth entirely to laboratory technicians, and may it be said to the credit of these technicians that, in the main, to judge their work from a purely technical standpoint, it is commendable. It must be admitted that when it comes to complying with the esthetic and physiologic requirements in arranging teeth in prosthetic dentures, it is essential that we develop a broader conception of what our duty is to the edentulous patient. The method as outlined is not presented as one that must be dogmatically adhered to: it may be modified in many ways.

IS ORTHODONTIA FOR THE ORTHODONTIST?*

By WALTER T. McFALL, D.D.S., Nashville, Tenn.

A TRULY great scientist who has materially contributed to longer life, happiness and good health has said, "Science is not for the scientists, but for the sake of humanity." I should like to paraphrase this statement and say to this very important and progressive section of our profession, "Orthodontia is not for the orthodontist, but for humanity." I have for years been greatly moved by the service the orthodontist renders his fellowmen, by the arduous and painstaking preparation he gives to his training, by his desire to know, and lastly, by the wonderful possibilities he has of helping the forces of heredity and environment, by cooperation and treatment, and by fulfilling in a most admirable manner a trust, assisting children to become healthy, happy and beautiful, with a finer chance of success, contentment and self-respect in adulthood.

Orthodontia as a science is comparatively a babe in the woods; yet, in twenty-five years, the rank and file of our profession has had an opportunity to see the benefits, to learn, even as many of you have learned, a few of the basic fundamentals which have positively gained desired results. As a science, your special phase of dentistry has made strides in method, practice, research, experiment, contributions to dental literature and organization. In admiration and respect of both the laity and the profession, you are second to no other branch of dentistry. Each and all of you who know in your heart of hearts that you have done your best should be congratulated.

I come to you today not as an orthodontist, though I have practiced some orthodontia, by any and all of your varied definitions of what your specialty really is or attempts to do and be. I do not come to you as a general practitioner in dentistry, though I have experienced the difficulty of honestly trying to perform that herculean task in both city and town. I come to you as one who is proud of dentistry as a profession and who desires to help you face the problem before us. Every worthy dentist must eternally work for the elimination of the need for his profession. To do less is unfair to those whom we should serve, and to fail to justify our work as an important part of the healing art. It will not be my endeavor to glorify your virtues and accomplishments—time and an appreciative clientele will do that. It will not be my intent to embarrass or hurt you for what you have left undone that you should have or might have done. I shall be practical in speaking out of my own experience. I shall be tolerant and endeavor to be fair and helpful. May we confer and then give action to our thoughts that we may more often build and serve? I bring nothing original or fanciful. I admire your work and I wish to see you do more for humanity's sake.

Every one here knows the definition of orthodontia. You understand its challenge, aims, hope and possibilities. Each

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of you knows whether you have had experience in the general practice of dentistry—yes, whether you have had enough or too much. You know better than any one, save your patients of the next five to ten years, whether you have been adequately or properly trained for this important specialized work which you claim to do better than average. I am directing my remarks to that person who has proved by results that he can and will deliver service which entitles him to be highly regarded as an orthodontist.

Is orthodontia for the orthodontist? It is not, never has been and never will be. Orthodontia is for humanity. We have learned that "little can be accomplished for grown-up people; the intelligent man begins with the child." Some one has said there are two ways of succeeding in life, one by intelligence, the other by education. Be that as it may, we will certainly need bountiful helpings of both if we are to fill our place in the sun. Many of your professional brothers in dentistry and medicine fail to appreciate and actively hinder you in the fine work you are doing or may do. Why? When orthodontia was first practiced, in the twentieth century, there were a very few who sacrificed, slaved and pioneered to make it possible, to actually give it a beginning. Many who criticize do not know the history of orthodontia, nor have they ever been impressed with the fundamentals of orthodontia as a science or specialized field of service in dentistry. I hasten to state that this is not their fault entirely, for you must remember the old adage: "Be not the first by whom the new is tried nor yet the last to lay the old aside." Then, too, most of our reforms, medical, dental and scientific advancements, have been given us by those who were almost fanatical in their enthusiasm, and sometimes we have failed to appreciate what these benevolent pioneers gave because we were green with envy or because we could not either comprehend the new or stand to see another comprehend it. Greater than all this is the point I have mentioned: the one who does not understand has not been impressed. Education must precede appreciation, and each of you has an important part in this educational problem encumbent on you as one who loves his work and art.

Do you remember your dental college days? If you graduated more than ten years ago, do you recall the instruction you received in orthodontia? Do not misunderstand: I am not condemning dental teachers then or now, nor am I admitting that dental education was all it should have been. The dental educators even admit that it was not; but to confine ourselves to the misunderstanding on the part of both the laity and the dentist: The lack of appreciation that the orthodontist is cognizant of every day, the tragedy of the forgotten child who is entitled to and would avail himself of this beneficent health service—think on this please. Who taught you orthodontia in the dental college? What did he teach you about orthodontia? Were you encouraged and inspired to attempt to treat some orthodontic cases in your general practice? Were you inspired to one day be a great orthodontist, to render the marvelous service orthodontists can render? What was your inspiration in your desire to be an orthodontist? Where did you go for help, advice, information and encouragement? What were you told? When you decided to go away for study in spite of your training, background, experience or encouragement or discouragement and disgust, whom did you go to, or where, and why? If, after you had taken a postgraduate course and were sincerely trying to do your utmost for your patients either in general practice or in the specialty, who and what broke

your spirit most often? If you will ponder some of these questions and allow your memory to run back for a brief interlude, we will be getting at a starting point in our discussion.

A great educator has said, "If there is ignorance in the world, the educators have failed. If there is sickness and disease, the physicians have failed." Might he not have added, "If there are malformed, deformed, misshapen, sickly, anemic, unnatural looking child faces in the world, the orthodontists have failed"? Yes, you, each of you, must do more than you have done for your patients, and for the two groups who influence and teach thousands more than you ever could—the general practitioners in dentistry and medicine and the laity. There is misunderstanding, a lack of appreciation, a penalty for the child, a harmful impression among the laity. Did you cause this? Yes and no. You did in that you did not inspire and teach the dentist; and the average dentist, in turn, honestly, and also because of jealousy, prejudice and lack of knowledge in a busy world, gave out false and hurtful advice to parents, patients and children; who, in turn, have passed it on until an obstacle almost insurmountable has been built up. You did not cause some of the jealousy and hatred, because you studied, sacrificed and strove to do your work well, to serve in an adequate and successful manner; and you have succeeded where the general practitioner has often failed. You did not cause it because you do not work as long hours and as full days as the general practitioner, nor do you get the enormous fees you are supposed to receive for a few hours' work.

Any one can find fault; but what is the answer? I hear you ask. I do not know; but I know this: more general practitioners are doing better dental work for children than ever before, and I believe that I know why. Every other problem in dentistry has been solved the same way, and I believe that a great many of your problems could be solved by conferring with the family dentist. Give the dentist what he did not get in his undergraduate days in dental college, show him the results of your research, your study. Show him how orthodontia can help him in restorative dentistry, in periodontia, in diagnosis. Urge him to face his full responsibility as a doctor of dental surgery. Let him know that you are interested in him and the work he is daily doing. Talk over your mutual problems. Help him to help himself. Form study clubs. Give papers and clinics that the men will be interested in. Talk diagnosis, causes, prognosis and the common responsibility you both have in a case. Insist on their doing the necessary operative and prophylactic work for your and their patients. Talk over the case and keep them interested. Help them with their problems in child and parent management in the dental office and in office and reception room management. Cooperate with them on health drives, school inspections and radio, civic and parent-teacher talks.

The general practitioner in dentistry wishes to do better. He is anxious to serve his patients. You can help him do this, and no one can do for you what you should do yourself. Local, district, state and national groups of dentists should be told what all of you know and are doing and can do. Nothing is permanent save change. Will each of you pledge yourself to do not only your part, but your best? Will you, through your dental journals and bulletins and on every occasion help the dentist to deliver the message that children should be seen early, regular and often enough, and should not be hurt? When you fail to help children, are you keeping faith with the pub-

lic who believe in you and want to know about your service?

"If the atomic theory proves sound, we have unearthed a vast reservoir of power, but it is physical power. All the world does not equal in power the quiet strength of one unselfish love. We speak not now of the love of man for woman; nor of the love of parent for child. The greatest motive power in all the world is the love of a real man for his brothers—that tender, unselfish regard through which his soul is connected to humanity."

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RELATION OF THE DENTIST TO THE COMMERCIAL DENTAL LABORATORY*

By CLYDE H. SCHUYLER, D.D.S., New York City

THE most rapid advancement in the practice of dentistry has occurred in the past thirty years. The interest of the dentist is no longer limited to the assurance of mouth comfort and the satisfaction of the vanity of patients. His responsibilities, as recognized today, are much broader. As the relation of mouth health to systemic conditions has been recognized, the dentist has been placed in the position of assuming responsibility not only for oral care, but also for rendering a health service. The prosthetic restoration, replacing one or all of the natural teeth, must today be recognized as a health service. Much of the work may be done on a manikin, but the denture is worn in the mouth of a living person and must function as a part of a living organism. It may or may not be symbolic of true artisanship, but its value depends on the application of the biologic and mechanical sciences. By the application of these sciences, a prosthetic restoration may become an integral and functioning part of the patient's masticatory mechanism. Without their application, restorative efforts may not only be unsuccessful but may also cause serious physical complications, either local or general.

While the dentist only is qualified by knowledge, skill and experience to coordinate these sciences in planning, constructing, fitting, adjusting and maintaining prosthetic restorations in keeping with the biologic, functional, psychologic and esthetic requirements of oral health service, economic conditions warrant the employment of trained technicians to assist the dentist in some of the purely mechanical details. The recently graduated dentist has a background of years of education and training, both theoretical and practical, which involves great expenditure of time and money; while the technician is merely finger-trained.

Many of our older practitioners received their training as apprentices and as such were taught the limited amount of mechanical dentistry required at that time. As years have passed and the concept of dental service has changed, more and more preparatory training has been demanded of the dentist, in keeping with the recognition of dentistry as a health

*Read before the Section on Full Denture Prosthesis at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 15, 1936.

service. There is reason to believe that even greater educational demands may be in store for the future practitioner. As dentistry has advanced from the crude practices of preceptor days to a recognized branch of the healing art, more and more has been expected of the dentists in prosthetic service.

Varied means of correcting dental defects have been developed, so that, at present, one or all of the human teeth may be replaced with artificial substitutes that function as integral parts of the oral structure and elude detection by the most critical observer. Many of the more modern types of restorations require precise work and a much greater expenditure of time, both at the chair and in the laboratory. Also, the newer materials, which have displaced vulcanite, require much more laboratory time. It would seem to be sound judgment economically on the part of the present-day dentist to turn over certain of the purely mechanical procedures to the trained technician. In so doing, he is in no way violating his responsibility to his patient, and, as the technician's time is less valuable than his own, he is able to render the same high type of dental service at fees that are within the means of a greater percentage of the population.

The most satisfactory cooperation between dentist and technician is possible when the latter is employed in the dentist's office. Close supervision of all procedures delegated to the technician is then possible, and a more complete understanding is assured of the requirements of the individual case, on which its success or failure may depend. Many dentists who do not have sufficient prosthetic work to warrant the employment of a private technician have found it entirely satisfactory to divide the services of a technician with one or two others. The day of the large prosthetic laboratories, where the responsibility for the technical procedures pass through many hands, is on the decline, and the private technician or the technician who serves a limited and selected clientele is becoming more popular.

The technician is an economic convenience to the busy practitioner, but the young dentist building a practice, or the older one whose time is not completely occupied, should utilize his otherwise idle hours by doing his own laboratory work. In the process, he may not only turn the balance sheets in his favor, but he is also developing both digital dexterity and judgment, thereby becoming more able to practice this branch of his profession either with or without the aid of a technician.

In past years, there has been much discussion as to whether the technicians should be classed as adjuncts of the dental profession or be classified as members of an industry. This question may never be settled to the satisfaction of all. There is one thing of which both the members of the profession and the technicians should be mindful; that is, that the dental profession is not dependent on the services of the technician, but the technician is wholly dependent on the profession.

It is unfortunate that some dentists make use of the technician's work in a way to reflect discredit on the profession, and that the greed or lack of understanding of some technicians, groups of technicians or laboratory owners causes them to act in a manner contrary to the best interests of the public, the dental profession and their own group.

Some dentists shift their responsibility in rendering health service. They send in preparatory work, such as impressions for full or partial appliances, maxillomandibular records or general instructions, of such inferior quality that the

most expert technicians could not render a satisfactory service. Certain others call on the technicians to make impressions, mouth records and tooth selections, give advice on esthetics and other procedures, or assume additional responsibilities that legally and morally belong solely to the dentist. Such practices reflect on the integrity of the profession and destroy the morale of the most conscientious technician. In full denture procedures, if the dentist fulfils his responsibility to his patient, he must secure good impressions of the mouth; make all corrections in the impression or cast; secure and verify maxillomandibular records, and select porcelain teeth of the proper size, shape and color, and arrange and modify them to restore the desired esthetics, phonetics and function. After the restorations are completed, the dentist must verify the maxillomandibular relation of the appliances in function and correct disharmony of occlusion in centric or eccentric positions; which necessitates remounting the dentures on an articulating instrument. He must also be responsible for subsequent mouth adjustments.

The technician can carry through all bench procedures which require no contact with the patient. The dentist, and dentist alone, receives that training in anatomy, physiology, bacteriology, histology, physics, chemistry and dental anatomy which basically qualifies him to render oral health service of a high standard. The technicians are finger-trained men, many of whom enter the work at an early age as messenger boys, later serving as apprentices who receive training for specific procedures in one department of a laboratory. Few receive training adequate to perfect them in all laboratory procedures.

The failure of a dentist to recognize his responsibility for the success of a dental prosthesis may be attributed to the fact that (1) through lack of time, he may have permitted himself to become careless; (2) he may not have kept abreast with the rapid advances in prosthesis; (3) he may have received insufficient training in undergraduate work; (4) fundamentally, he may lack mechanical judgment and ability. If he has been allowed to graduate and enter into the practice of the profession with the third and fourth impediments, the dental school is responsible, rather than the state board of dental examiners. The dental school has supervised his work each day for several years and is in a better position to pass judgment on his abilities than the dental examiners who watch him do one or two pieces of work for which the student has been especially trained.

In his report on "Dental Education in the United States and Canada," William J. Gies attributed the superiority of American dentists over foreign dentists to the fact that they receive more, and a higher type of, technical training. Perhaps some of our schools are spending a disproportionate time on theory and are neglecting the technical aspects. Practical training and experience in full and partial denture prosthesis can be obtained by the student in no way other than by constructing many and varied types of dentures under supervision.

Many schools are so located that it is not possible for them to obtain more than a very limited number of patients for prosthesis. I have in mind such a school in which, because of the scarcity of cases, the responsibility for a prosthesis is divided among several students, one taking impressions, another maxillomandibular records, etc., the responsibility falling on whoever happens to be in the prosthetic infirmary when the patient arrives. Other schools which, through natural advantages in location, should have an adequate number of prosthetic patients have failed

to develop their prosthetic clinic, perhaps owing to the poor quality of service rendered.

Certain schools require the student to spend about one-half as much time in the prosthetic department as in the operative department. The director of one prosthetic department told me that he considers it essential to teach only the bare fundamentals of denture prosthesis, and that from four to six practical cases were sufficient for this purpose. It is difficult to understand what is meant by "fundamentals." There are no duplications in denture prosthesis. Each case presents its unique and individual problems, and consequently, if a student constructs twenty-five prostheses, he will have a broader experience and more self-confidence, and, in general, be better prepared to assume his responsibility in rendering such services after graduation. The curriculum as recently advocated by the American Association of Dental Schools suggests approximately 591 hours, or the equivalent of four months, for the study of denture prosthesis. This time does not include the time required by basic subjects prerequisite to the study of denture prosthesis.

The authoritative statement has been made that ten years is required to develop a capable prosthodontist. Is it surprising, then, that a student who has been given but sixteen weeks in prosthodontics and who has had a supervised practical experience limited to the construction of only from four to six restorations should be inadequately qualified to perform this service after graduation? Is it not understandable why, in consequence, he seeks advice from the technician, who, although having no knowledge of the sciences, has had years of practical experience in laboratory technic? As a consequence, technicians wax sarcastic about the limited ability of certain members of the profession and advocate legislation permitting technicians to perform direct prosthetic service for the patient. In certain foreign countries, the technician has been given such rights, with a resultant lowering of the quality of service rendered, which, at its best, never equaled the standard established in this country.

In the interest of public welfare, we cannot conceive of this privilege ever being granted in the United States to a group the major portion of which consists of men who have received their elementary training as messenger boys. Only chaos and a decline in the quality of oral health service would result.

The quality of prosthetic service will be comparable to the high quality of service rendered in other branches of dentistry and cease to reflect discredit to the profession only when adequate consideration is given to the teaching of denture prosthesis to the undergraduate in dental schools, and to the postgraduate in dental schools, dental societies and study clubs. While lecture courses are of value, practical demonstrations effectively convey more definite information, and the best results are obtained when each student is permitted to work on a large number of cases, under supervision.

Dental colleges and dental societies could also render a great public and professional service if they would make available to the general practitioner a consultation service comparable to that received in the hospital by the physicians. Dentists could then receive the counsel and advice from a qualified professional colleague in solving his problems or planning restorations, rather than from a laboratory technician.

The dental profession in some localities has seriously objected to the dental school clinic. Theoretical knowledge is essential, but the ability to apply that knowledge is obtainable only by super-

vised work for patients in the school clinic. Take away or restrict that clinic, and the graduate will be a helpless "book-taught Bilkins," whose practical application of his theoretical knowledge will reflect discredit on the profession. The natural consequence is that these poorly trained men are driven into an unethical relationship with the commercial dental laboratory. It must constantly be kept in mind that the public respect accorded dentistry in this country was built not on theory, but on the high grade of oral health service rendered.

While it lies within the power of the members of the profession to correct the undesirable practices existing between certain dentists and certain technicians or laboratories, the dentist is not the only offender. The technicians may be divided into two groups. Those in the first group, in which a large majority of the technicians may be placed, recognize their position as assistants to dentists. They accept the judgment of dentists and fill prescriptions as the druggist fills the prescriptions of the physician. Some of this group of conscientious laboratory workers have been imposed on by members of the profession. They receive preparative work, impressions, etc., of an inferior nature from indifferent or inefficient dentists and, under economic pressure, are forced to adopt irregular practices for them. The second group of technicians is motivated by selfish considerations. They apparently have no regard for fair principles in competition with other laboratories, or for the welfare of the public whom they indirectly, and sometimes directly, serve.

We have only to review a few statements made by members of the latter group as evidence that their existence is a menace to public welfare. While they are in a minority, their numbers are sufficient to make it important that their activities not continue unchallenged; for these technicians aggressively malign and strive to discredit the profession on whom they are dependent for a livelihood. Examples of this attitude may be found in the record of the public hearings on the codification of prosthetic laboratories under the National Recovery Administration. A few examples follow:

Hugo Pollock ("Code Hearing," page 156): "It seems to me that this is an industry that should be ready to reduce the hours and increase the wages, and I am not so much afraid of the public being socked too much, because I do not believe the products sold to the public actually cost the dentist over 15 to 20 per cent of his bill."

Henry Posner ("Code Hearing," page 172): "Up to now, all the work was done by a junior technician, and now it goes to the head man, who without seeing the patient, without having the slightest inkling of the contour of the patient's face, must choose the form and the size of the teeth and set them according to the particular anatomical peculiarities of a given mouth. Upon this setting depends the appearance of the patient, his ability to masticate and to speak."

Statements of this nature, common during the code hearing, and similar ones that have been made during legislative hearings on proposed licensing of dental technicians, are meant to convey to the public that the technician and not the dentist is largely responsible for the success of their prosthesis, and that the dentist is a merciless profiteer. Misstatements of this nature are not only misleading, but are also a reflection on the integrity of the profession. Only one motive can be attributed to those making such statements, and that is, to mold public opinion to fit their own selfish purposes.

Consider with this the appearance in the public press of advertisements of

prosthetic laboratories and of mail order houses selling dental prostheses. The *Bulletin of the Chicago Dental Society,* May, 1934, states:

It was something of a shock that we were recently advised of the existence of a substantial volume of dental laboratory advertising in the classified columns of one of the metropolitan daily newspapers. Our shock was repeated when it was learned that several of the offenders, far from being uninitiated in the field of ethics, were among the leaders of the local laboratory industry. . . . The only logical conclusion is that a laboratory advertising in a public medium expects direct public support.

In July, 1934, the *Laboratory Technician* (an official periodical of laboratory interest) supports the illegal practices of technicians:

Nor do those who patronize the illegal practitioner for denture work feel they are dealing with crooks. Rather they think they have made a good stroke of business by eliminating the middleman. They get the same kick out of getting a denture direct that a dentist gets out of buying a radio, or a suit of clothes, or a set of furniture direct, or wholesale. Any dentist will cut out the middleman on any purchase at any time. And we might add, who doesn't? What dentistry must remember is that to the public there is nothing so inherently sacred about a set of teeth that they should require the ritual of a dental office to make them function.

We should also be mindful of the fact that it is becoming increasingly difficult to penalize these offenders through court procedure; which may be an indication that they are obtaining some public support. If they desired to do so, the dental laboratories could exert a profound influence in stamping out the illegal practice of dentistry. The N.R.A. Code stated that "no member of this industry shall accept any dental restoration for adjustment, repair or processing except from a dentist or from another dental laboratory." Violation of this rule carried a penalty of a $500 fine; yet, to my knowledge, no violators have been so punished.

Should not we, as members of the dental profession, show our resentment of these efforts to exploit the practice of dentistry? Has not dentistry within its power the correction of these evils and the preservation for dentistry of the practice of dental prosthesis, thereby maintaining for the public not only the present high standard of dental prosthetic service, but also, as past history clearly indicates, a continued improvement in the quality of that service?

The use of unproven dental materials has too often been promoted by dental laboratories with a resultant loss of time and goodwill by the dentist. Dental materials are analyzed and tested, and the requirements for such materials are specified by the National Bureau of Standards in Washington. The use of recommended materials will protect the professional standards of the dentist and the quality of oral health service to the public.

In discussing this problem, some consideration should be given to the appearance on dental society programs of representatives of laboratories or commercial houses. Should the dental profession control dental education, or should it be delegated to commercial houses? Is the dental profession capable of directing dental education or must it depend on commercial representatives? On the answer to these questions depends the future of dentistry. Is it to be an honored profession or a trade?

The following editorial, entitled "Clinics and Demonstrations," from the *Hudson County Journal,* of New Jersey, January, 1935, is most expressive:

Osmun and Cook are to be complimented on the good taste displayed in their choice of the word "Demonstrations" to

describe their recent display of new materials, methods, etc. In this connection, the word "clinic" is continually being misapplied.

Dr. Winter, demonstrating to the dentist of a community the proper method for removing impacted molars, is giving a "clinic," but Dr. Blank, paid by a manufacturing concern to advertise that concern's products, is not a clinician nor in such a capacity is he even a professional man. His position is analogous to that of the young lady in a grocery store introducing a new kind of breakfast food, useful perhaps, and honorable enough, but just a part of the business.

Let us salute the sentiment and leadership contained in this editorial. Are these commercial representatives "invited" to appear on our programs because they wish to elevate the dental profession or because they seek patronage? I should not use the word "invited" because, in many instances, the invitation is obtained through solicitation, and although the commercial representative is reimbursed for expenses and, at times, receives compensation, he would, in most instances, gladly pay for the privilege as a means of direct advertising.

An article in the *Dental Technician* is self-explanatory:

A properly conducted clinic can hold the individual attention of your dentist patrons for an hour and a half. In that period of time you are a poor demonstrator if you cannot convince your listeners of the sincerity, interest, and capability of your laboratory to do the job just a little better than the other fellow.

Honorable and worthy as the presentation may be, it is still a commercial demonstration and should be given as such.

Those who have favored the appearance of commercial representatives on dental society programs present some threadbare arguments to support their position. One has sympathy for the unfortunate laboratory owner who receives poor preparatory work and who, desiring the opportunity to improve conditions, believes he should be privileged to appear on the society program to discuss them. Dentists should insist that the laboratory proprietor, if he desires to correct the faults of his patrons, appeal to them personally or in a group; or the desired information may be transmitted to them by mail. It will be found that this does not adequately meet the ambitions of the laboratory owner. He wishes an audience, not of professional men seeking knowledge, but of patrons and prospective patrons.

The other common excuse offered in justification for the appearance of commercial representatives on our programs is that they have spent an enormous amount of time and money preparing their material and, in consequence, can give a pleasing presentation. Certain commercial houses spend many thousands of dollars a year in advertising. Society programs constitute the most direct form of advertising. What if they do spend thousands of dollars in preparation of moving pictures or table clinics? Such expenditures are not those of philanthropists whose interest is in elevating the dental profession, but of smart business men who expect increased financial returns as a result of the investment.

I have been told that certain dental colleges are using movies or slides prepared by commercial laboratories for the teaching of prosthetic dentistry. A faculty that depends on such a source for teaching material characterizes itself by the act. There must be available able men with a professional background to teach dentistry in colleges and societies. Our leaders must be independent thinkers, free from commercial influence. Otherwise, we must expect such detri-

mental influence to be reflected in the conduct of those who follow such leadership.

CONCLUSIONS

While the great need for a better prosthetic service is recognized, great advances have been made in the past score of years. The fact that a dental prosthesis cannot be made by formula or cast from a master pattern, but that each restoration is a creation in itself, founded upon a knowledge of art, mechanics and biology, precludes the possibility of mass perfection. As long as dentistry is inspired by the will to improve its opportunities in relation to the public health, we are assured of continued progress in dental prosthesis. It is essential that the practice of dental prosthesis continue to be a legal and an inalienable part of the practice of dentistry; also, that the teaching of dental prosthesis in dental schools and societies be not subjugated to the influence or exploitation of commercial interests.

That the demand for lectures and postgraduate courses in denture prosthesis are greater than for any other branch of dentistry indicates the need for increased interest in methods of teaching the subject to both undergraduate and postgraduate students. Dental schools and dental societies should meet this responsibility.

If technicians or commercial dental laboratories are sincere in their expressions of interest in the public welfare, they should prove it by ceasing to offer illegal services to dentists, and they should take the responsibility for penalizing the members of their group who, through serving the public directly, violate the dental practice act of the state.

The dignity and honor of the dental profession would be upheld, its sphere of usefulness extended and the advancement of dental science promoted, if the dental profession actively interested itself in discouraging reprehensible practices by the commercial dental laboratories and technicians. This could be effectively accomplished if the American Dental Association formulated a code of conduct for prosthetic laboratories and technicians and called on dentists to withhold patronage from all who violated the principles of the code.

400 Madison Avenue.

Treatment of Maxillofacial War Injuries—There are two main principles: (1) conservation of injured teeth and loose fragments of bone; and (2) fixation of displaced fragments of jaw in correct position. The dental officer should be most conservative with regard to extraction of teeth, because of their importance in the retention of appliances. The exposed pulp of fractured teeth should if possible be removed at once when the teeth may be valuable in subsequent treatment. Unless a tooth is actually involved in the line of fracture, it usually should not be disturbed. The retention of partly detached fragments of bone concerns both the surgeon and the dentist. The recuperative power of the fragments is usually good and as a rule none should be discarded. The slightest attachment of periosteum is justification for retention of a fragment. As long as teeth are present in the fragments and in corresponding region of the maxilla, the dental officer should immobilize the fragments in normal occlusion by interdental wiring. Even if the whole mental region is lost, the molar fragments should be held in normal occlusion by this means.—Report of Committee on Treatment of War Wounds, London Letter, *J.A.M.A.*, Oct. 17, 1936.

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C. N. JOHNSON, Editor

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Editorials

AGAIN THE CHRISTMAS SEALS

There never was in all of the enterprises of man a more worthy benefaction than that represented by the Relief agencies of the American Dental Association. If the rank and file of the profession could be made to know all of the devotion and energy that are being put into this enterprise and all of the ramifications that go into its operation, there would be such an outpouring of sentiment and assistance that the future of the Relief Fund would be assured beyond the peradventure of a doubt.

Without realizing the facts in the case, a certain few have ventured to question the necessity of accumulating any appreciable amount in the way of a fund for protecting unfortunate members of the profession. They forget. No one can predict when some major misfortune may occur and overwhelm great numbers of the profession in a common calamity that will tax the relief resources of the profession. Remember the San Francisco fire. And also remember, in this connection, the noble band in that superb city who were instrumental in creating a nucleus for the very fund that rep-

resents the present Relief resources of the American Dental Association. Let it be repeated once more that the first substantial contribution to this fund came from the profession of San Francisco after recovery from their disaster. It may not be generally known, but this is what happened: The appalling suddenness of their terrible calamity left the profession well-nigh overwhelmed, and, as is usually the case, an outpouring of sympathy and assistance came from the profession elsewhere. Never was a need greater, and never was one met more promptly or generously.

But the most significant thing in the whole situation came when the urgent need was over. No sooner were the stricken ones on their feet again than they showed their magnificent independence of spirit by announcing to the world that they were no longer in need, and that they did not desire any further aid. They had nothing of the spirit of the dole in their make-up, and thus they furnished an object lesson for certain of our citizens of the present day who are constantly clamoring for more and ever more in the way of help. In contrast with this, these San Francisco men carefully conserved the remnant of what was left from the contributions of their fellow members, and tendered it to the American Dental Association as the nest egg of a permanent fund to be set aside for the relief of future unfortunates. And, as has just been said, it was this that made the first substantial contribution to the present Relief Fund. Manifestly, it was soon discovered that if the principal of the fund were used, it would rapidly become depleted and thus the enterprise would fail; so it was wisely determined that two safeguards should be thrown around the fund: First, that only the interest of the fund would be available for relief, and, second, that the component societies must match the amount contributed by the parent body. With this arrangement, it became apparent that if an adequate fund were to be maintained to make available relief for an appreciable number, it must be augmented by the addition of more and more principal. The manner of building this fund was through the medium of the Christmas Seals, and this has proved encouragingly effective.

Many thousands of dollars have thus been distributed for the benefit of those members of our Association who have fallen on

difficult lines, and the pleasing reflection is that, in the building of this fund, there is sufficient of sentiment to appeal to the sympathies of every one of our members.

What could be more appropriate than to mingle the beneficence of relief with the cherished memories of the Yuletide! Christmas is the one outstanding urge of our better nature. Around the sentiment of Christmas cling the tenderest memories of our lives. Christmas represents the sanctuary of the home and hearth; the sacred citadel of our most cherished affections. The mistletoe and holly; the shrill alluring laughter of little children; the chimes lending their cadence to the ambient air. All nature seems to blend in a pean of praise and gratitude. The patron saint smiles on all alike: the poor, the rich; the humble, and the proud. Every fireside reflects the brightness and cheer of the hour; every vagrant ray of light illumines the heart of some one.

And when we think that those in need are succored by the bounty of those more fortunate, our hearts swell in common charity and good will, and we are bound more closely together in a fraternity of fellowship and comradeship.

The seals are the emblems of hope and happiness. They mean so little in sacrifice, so much in saving grace. Let every member to whom the seals are sent this year respond with heartiness and cheer. It will invoke a double blessing—a blessing to the recipient and an equal one to the benefactors.

THE AMERICAN DENTAL ASSOCIATION TAKES OVER THE DENTAL COSMOS

By agreement between the American Dental Association and the S. S. White Dental Manufacturing Company, former publisher of the *Dental Cosmos,* the latter journal has been taken over by the American Dental Association.

The *Dental Cosmos* was tendered to the Association as a gift. Further details will be announced in the January issue.

OREGON AND UTAH LEGISLATION ON ADVERTISING OF INTEREST TO DENTISTS

The following statement by the Committee on Legislation of the American Dental Association will be of especial interest at this time:

COMMITTEE ON LEGISLATION, AMERICAN DENTAL ASSOCIATION

Nov. 4, 1936.

The many inquiries received by the Committee on Legislation would indicate a keen nation-wide concern on the part of those interested in dental legislation in the organized efforts made in Oregon and Utah to repeal certain provisions of the dental laws of those states through proposed amendments by initiative referendum petition.

OREGON

In Oregon, the proposed amendment, which came before the voters of the state at the November general election and was defeated read as follows:

Be It Enacted by the People of the State of Oregon:

That Article I, which is the Bill of Rights, of The Constitution of the State of Oregon be and the same is hereby amended by adding thereto Section 39, which is as follows:

Section 39. No advertisement of any business, vocation, profession, service, or of the sale of any goods or other property, or of any quality, price, or other detail in connection therewith, ever shall be prohibited or regulated; provided that the advertisement states the truth.

All provisions of the constitution and statutes of this state and of the common law in conflict with the provisions of this section are hereby repealed.

The Portland Better Business Bureau led the successful campaign that defeated this vicious legislative proposal, the ethical dentists of the state united with them in a well-organized effort to bring to the attention of all voters in the state the danger to the general welfare and the real purpose of this amendment, which was masked by a title so apparently innocent as to be easily misleading to the uninformed. So far as we have learned, no civic or state organization endorsed the amendment, but a great many voters' leagues, woman's clubs, chambers of commerce, industrial and professional organizations and certain newspapers took an active part in bringing about its defeat.

This general opposition by lay forces was intensely gratifying to the ethical members of the dental profession. While they, on their part, gave every possible assistance, worked whole-heartedly and were untiring in their effort, they were able to leave to these lay organizations active direction of the attack on the proposed amendment.

UTAH

In Utah, an attempt to place on the November election ballot an amendment repealing provisions of the dental law (against advertising) adopted in 1935 was made by initiative referendum petition*; its sponsors claiming to have secured the signatures

*A copy of this amendment will be found on page 2398 of this issue.

of 10 per cent of the registered votes of the state. The ethical dentists of Utah, by court action, promptly obtained a duplicate list of these signatures, promoted an educational campaign and obtained withdrawals of 9,000 names from this petition.

The secretary of state and the attorney general refused to recognize the legality of the withdrawal petition, proceeded to advertise the amendment and certified its appearance on the official ballot. Appeal was then made to the state supreme court, which reversed the ruling of the attorney general and ordered the proposed amendment removed from the election ballot.

This decision by the state supreme court will no doubt bar any future attempt in Utah to nullify their dental law by initiative referendum. The victory in these two states, far-reaching in importance to the profession, marks another forward step in our nation-wide effort to drive out of the profession of dentistry those practitioners that by fraudulent and deceitful advertisements and practices, prey on the gullible and menace the public health and welfare.

Let it be said that THE JOURNAL stands solidly behind the action of the Legislative Committee and the Oregon and Utah dentists in their earnest effort to stamp out illegal or fraudulent advertising in these two states. The members of the profession have put up a valiant fight against strenuous opposition and they are entitled to the gratitude of every member of organized dentistry.

In the May, 1935, issue of THE JOURNAL, page 831, pointed reference was made to this question, on which comment will again be made as occasion arises.

Labor with what zeal we will,
Something still remains undone,
Something uncompleted still
Waits the rising of the sun.

This observation of Longfellow might hold within it the germ of futility and discouragement if we failed to see all around us the rewards of labor and the steady progress that we are making in our plans and in their fulfilment. After all, while we may not always hit the ball, it is something to realize that at least we are playing the game.

PRACTICE IN PARAGRAPHS

This department is intended for busy readers. It aims to tell a vivid story in a few words. Items should be of a practical character, and free from padding—not more than a paragraph or two. We exact no limit, but two hundred words can tell most of these stories. Send in your ideas; they will be welcome.

Tissues for Table Covers—Large size cosmetic tissues are indispensable for bracket table covers.—*John H. Clow, Rochester, N. H.*

X-Ray Developing Tank—A storage battery box which has three compartments makes an excellent x-ray developing tank.—*John H. Clow, Rochester, N. H.*

Bridge from One Impression—Bridges with inlay abutments are now being constructed in the entirety from one impression and one cast.—*C. C. Norris, Oshkosh, Wis.*

Placing Material in Tray—Do not use oil or vaseline on denticoll when it is in the tray. A finger dipped in water will aid in placing the material in the tray.—*C. C. Norris, Oshkosh, Wis.*

Porcelain Filling—If the gingival margin of the celluloid strip is shaped to conform to the curvature of the gingiva, an overhanging margin will be avoided.—*J. Leo Epstein, 481 73rd St., Brooklyn, N. Y.*

Tongs for Handling Hot Rings—Tongs purchased from the 10-cent store for kitchen use, as for ice cubes, potatoes, etc., can be used for handling hot casting rings, etc.—*John H. Clow, Rochester, N. H.*

Cause of Gagging—Gagging from the presence of the upper plate is caused by the fact that the plate is not sitting tightly enough against the palatal surface, tickling or irritation resulting—*C. C. Norris, Oshkosh, Wis.*

Procaine Injection—If the patient is a child or a nervous adult, the needle should be covered with a piece of sterile cotton roll before the dentist approaches the chair with the syringe.—*J. Leo Epstein, 481 73rd St., Brooklyn, N. Y.*

A Neglected Use of the Roentgenogram—The gold inlay should be examined roentgenographically before cementation, to determine whether the gingival margin fits as well as the inlay looks. This measure will save many teeth.—*J. Leo Epstein, 481 73rd St., Brooklyn, N. Y.*

Cavity Lining in Silicates—One should apply cavity lining to each cavity prepared for synthetic porcelain. A straight bur (or a bur for the straight handpiece), a small round one, is dipped into the cavity lining and applied to the prepared cavity and dried.—*Ralph E. Gieringer, Cincinnati, Ohio.*

Showing the Patient—If you have finished polishing a good amalgam filling or have just inserted a well-fitting inlay, pick up your mirror and show it to the patient. Very few people examine their teeth closely, and they will appreciate your work better if it is actually pointed out to them while seated in the chair.—*J. Leo Epstein, 481 73rd St., Brooklyn, N. Y.*

Mercury Fillings—Indispensable as amalgam is, if patients knew it was one-half mercury, they might not want so much of it. Gold foil fillings are positively the best for lower bicuspids Class 1 in teeth of good quality. The only excuse for neglecting gold foil in these cavities is the flatness of the patient's purse and the thinness of the dentist's ambition. It is the dentist's duty to apprise the patient of the relative merits of the materials used as to permanence. Some dentists contend that their patients do not want gold foil, when they have never been given a chance to choose. The dentist must do most of what he does best, but not to the exclusion of gold foil entirely. —*Herbert Ely Williams, Red Bank, N. J.*

Visualization—Some dentists are adverse to showing their patients a single thing and use the ear as a receiving station. The ratio between eye and ear impressions is estimated as 90:10—too much difference to be indifferent about. Patients who pay are entitled to know and are better satisfied when shown than told. "One picture is better than a thousand words," is a Chinese saying which is old enough to be new and new enough to be tried again. Showing is knowing and patients are entitled to know to a reasonable degree what is being done. The effect of visualization in behalf of the patients is often transmitted by them to others, who are impressed with the thoroughness of the dentist using that educational feature.—*Herbert Ely Williams, Red Bank, N. J.*

Intra-Osseous Anesthesia—Intra-osseous anesthesia was advocated and tried about twenty years ago. It was found to have no advantages over those methods generally in use. Owing to the impracticability of the method, or to faulty technic aseptically, some serious infections developed after its use. After being discredited, discarded and forgotten, it is now being advocated again. Injection into the alveolar process, after drilling a little hole in the cortical layer, is a dangerous procedure. The wound thus created is not at all comparable to those we created in the usual surgical procedures about the mouth, as the latter have adequate drainage. As you value your own peace of mind and your patient's safety, stick to tried and proven methods of local anesthesia. When these fail, resort to some form of general anesthesia.—*Henry B. Clark, 1132 Lowry Medical Arts Bldg., St. Paul, Minn.*

COUNCIL ON DENTAL THERAPEUTICS

ACCEPTED DENTAL REMEDIES

The following articles have been accepted as conforming to the rules of the Council on Dental Therapeutics of the American Dental Association. The Council wishes dentists to understand that the admission of an article does not imply a recommendation. A copy of the rules that govern the Council in the consideration of articles will be sent on request.

SAMUEL M. GORDON, *Secretary*

DENTIFRICES*

Pycopé Tooth Powder.[1]—Composition: Each 100 gm. is stated to contain sodium chloride, 50 gm.; sodium bicarbonate, 35 gm.; tricalcium phosphate (Victor), 5 gm.; calcium carbonate (Snow Top Extra Heavy), 5 gm.; magnesium carbonate, 4 gm.; flavoring (oil of cloves and methyl salicylate), 1 gm.

ABRASIVENESS: 0.7 mg. (2 water, 1 paste) on silver specimen under 143 gm. in 2,000 revolutions (Victor apparatus).

Manufactured by Pycopé Inc., Joplin, Mo. No U. S. Patent. U. S. trademark 203,276.

Hennen's Tooth Powder.[2]—Composition: Each 100 gm. is stated to contain precipitated calcium carbonate (Sturge's Light or "50" density), 83 gm.; olive oil Castile soap, U.S.P., 6 gm.; sodium salicylate powder, U.S.P., 3 gm.; sodium chloride (finely powdered), U.S.P., 3 gm.; oil of peppermint, U.S.P., 1 gm.; saccharin soluble, U.S.P., 0.20 gm.; oil of spearmint, U.S.P., 0.50 gm.; gum tragacanth powder, U.S.P., 1 gm.; and mineral oil, U.S.P., 2.30 gm.

ABRASIVENESS: 1.1 mg. per thousand revolutions (John & E. Sturge instrument).

Manufactured by Hennen Products, Wheeling, W. Va. No U. S. patent or trademark.

THYMOZIN—NOT ACCEPTABLE FOR A.D.R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary*

Thymozin is a preparation that is sold to dentists for pulp capping or for basing prior to restorations. It is said to form "a resistant, antiseptic capping over pulps that are exposed or nearly exposed," and to afford "a valuable aid in achieving one of the recognized ideals of modern dentistry—Pulp Conservation."

The description continues:

This preparation contains pure Thymol and pure zinc oxide, specially freed from arsenic. Its analgesic, stimulating and non-irritating properties, and its persistent antiseptic action make it excellent for its purpose. . . . It has been used successfully for twenty-three years. It is indicated in all cases where the pulp has been exposed or nearly exposed; in deep cavities where the

*Accepted Dental Remedies, 1935, p. 91.
1. Revised composition. (Compare A.D.R. 1935, p. 95.)
2. Revised composition. (Compare A.D.R. 1935, p. 94.)

symptoms indicate acute pulpitis without degenerative changes; and in cavities, resulting from slowly progressive caries, with deep infiltrated dentin requiring correspondingly thorough sterilization.

Directions for the use of the preparation are given.

In advertising which accompanies the product, the following appears:

Pulp dies under all kinds of filling materials and in teeth that never have been filled

THE SIX PRINCIPAL CAUSES OF PULP DEATH

All Preventable

1. BACTERIAL INVASION through a cavity.
2. BACTERIAL INVASION through the foramina.
3. THERMAL SHOCK through loss of normal covering.
4. THERMAL SHOCK through a filling or restoration.
5. CHEMICAL IRRITATION. Unsuitable chemicals, oils or drugs used to sterilize or desensitize dentin. Free acid from cementitious materials—especially when mixed *thin*.
6. MECHANICAL IRRITATION. Traumatic shock caused by grinding. Traumatic occlusion. Pressure on thin dentin, etc.

General subnormal vitality (as in periods of long illness) has a contributing influence in all cases.

A qualitative statement of composition does not appear on the package or in the advertising. Inquiry was made of the firm regarding the qualitative and quantitative composition, and the firm was supplied with a copy of the rules of the Council, but receipt of this letter was not acknowledged.

The following also appears in the advertising:

When Thymozin does not serve to maintain healthy and comfortable conditions in a pulp that is threatened by infection, irritation, or shock, nothing else will do so, and pulp amputation is the only recourse.

It is hardly necessary in this place to discuss again the limited success that one may expect from the pulp capping process. This subject has been adequately reviewed in the textbook on operative dentistry by McGehee, reference to which was made in the report on carbol eugenol. (J.A.D.A., 21:1692 [Sept.] 1934.)

Examination in the A.D.A. Bureau of Chemistry indicates that Thymozin No. 1 is composed essentially of thymol. Thymozin No. 2 may be simulated by bringing together zinc oxide, 43 parts by weight, and thymol, 57 parts by weight. (After this examination was completed, a reference to Thymozin was found in Gehe's Codex, 1929. It is marketed in Germany by H. DeTrey. No. 1 is thymol; No. 2 consists of approximately equal parts of zinc oxide and thymol.) Both of these agents singly or collectively have been used for long periods of time for pulp capping. They are nonproprietary agents which may be purchased at a cost much less than the cost of Thymozin. Adequate evidence is not available to the Council that the Thymozin preparations are more useful than certain well-known drugs used for this purpose.

The formulary in Accepted Dental Remedies, 1935, page 199, refers to the use of (1) zinc oxide and eugenol, (2) thymol melted over the exposed pulp and (3) a mixture of zinc oxide, 2 parts, and thymol, 1 part. Directions for preparing the latter are given. For the zinc oxide-thymol combination, credit is due Hermann Prinz. Information as to it and its use is readily available. (Aiguier, J. A.: Dental Medicines: Modern Pharmacologic and Therapeutic Principles Applied to Their Use in General Practice, D. Cosmos, 75:1184 [Dec.] 1933.)

The Council cannot accept thymol and mixtures of zinc oxide and thymol under proprietary names, since they are readily available materials. The claims for Thymozin appear to be misleading, particularly the above quoted one:

When Thymozin does not serve to maintain healthy and comfortable conditions in a pulp that

is threatened by infection, irritation, or shock nothing else will do so, and pulp amputation is the only recourse.

The same statements apply equally to thymol, zinc oxide and eugenol, or a mixture of zinc oxide and thymol, if the limited success that may be expected from pulp capping is borne in mind. More important considerations for pulp capping than as the protective covering used are the proximity of caries to the pulp and condition of the pulp, to mention only two. The pulp-capping situation may be summarized somewhat as follows:

1. It should be attempted only in favorable cases.
2. The indications for its use are: accidental exposure and the presence of teeth with incompletely developed roots or badly broken down teeth that it is otherwise impossible to save.
3. As precautions, arterial hyperemia must be relieved, and sterilization of the field carried out, with adaptation of the capping material without pressure.
4. The materials are zinc oxide and eugenol, thymol (for anterior teeth) and zinc oxide (2 parts) plus thymol (1 part).

In view of the foregoing, Thymozin No. 1 and Thymozin No. 2 are declared inadmissible for A.D.R.; i.e., because a quantitative statement of composition is not given, unwarranted therapeutic claims are made and the Council cannot grant the right of the firm to a proprietary name for a mixture of readily available drugs.

The chemist's report follows:

THYMOZIN-CAULK 1 AND 2

Five original packages of Thymozin (L. D. Caulk Co., Milford, Del.), price $1.50 each, were purchased on the open market.

Each package contained two small containers, marked Thymozin 1 and Thymozin 2.

Thymozin 1.—Each package opened contained approximately 4 gm. of a light amber yellow, soft crystalline material with an odor of thymol.

The product melted at 49.4-51 C. to a yellow liquid. A specimen of thymol, U.S.P., melted at 49.6-51 C. A mixture of approximately equal parts of Thymozin and thymol, U.S.P., melted at 49.4-51 C.

Test 419 (2) for thymol, described in "Identification of Pure Organic Compounds" (Mulliken: vol. 1, page 110), was applied to Thymozin 1, thymol, U.S.P., and a mixture of the two. The product obtained from Thymozin melted at 107 C.; the product obtained from thymol, U.S.P., melted at 106.4-106.6 C., and the mixture of the two melted at 106.6-107 C.

A 3.5 dinitrobenzoate derivative was prepared according to the method described by Max Phillips. (J. Am. Chem. Soc., 53:1924, 1931.) The product obtained from Thymozin melted at 102.8 C.; the product obtained from thymol, U.S.P., melted at 103 C., and a mixture of the two melted at 102.8 C.

From the foregoing, it may be concluded that Thymozin 1 is thymol. This was further confirmed by quantitative analysis according to the method described in the "Official Methods of the American Association of Official Agricultural Chemists," third edition, page 469. Thymozin 1 was found to contain thymol, 100 per cent.

Thymozin 2.—Each package contained approximately 3.6 gm. of granules of a white to slightly gray color. Each granule was about 1 to 2 mm. in diameter. The odor of thymol was predominant.

Qualitative tests indicated the presence of zinc, presumably zinc oxide. On ashing, the preparation was yellow at high temperature and white on cooling.

Thymol was identified by the test from Mulliken, described under Thymozin 1.

Quantitative determination yielded the following:

Ash (900 C.)	42.9 per cent
Ash (after sulfating)	42.9 per cent

Sulfated ash ....84.7 per cent
Alcohol soluble (thymol).....54.8 per cent
Thymol (by titration).....55.9 per cent

From the foregoing, it may be concluded that Thymozin No. 2 can be made by bringing together thymol, U.S.P., 57 parts by weight, and zinc oxide, 43 parts by weight.

ALBODON—NOT ACCEPTABLE FOR A.D.R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary*

In view of the chemical examination of Albodon, which appears below, it is declared unacceptable for A.D.R.; i.e., because the stated composition cannot be confirmed by examination (conflict with Rule 2, tests of identity and purity).

Albodon is put out by William R. Warner & Co., Inc., New York City. According to advertisements in certain dental journals, it "brings together three important ingredients you recognize as especially well adapted for dental cleansing and oral hygiene: sodium bicarbonate, sodium perborate, and sodium chloride."

Because of the untoward effects experienced from the indiscriminate use of sodium perborate in so-called daily hygiene of the mouth, a number of trademarked brands of tooth powders on the American market were qualitatively examined for sodium perborate. Two different samples of Albodon, purchased approximately three months apart, were examined for sodium perborate, which was not found. Because of the emphasis placed in a circular which accompanied the can on "The value of sodium perborate as an oxygen liberating cleanser," an independent microscopic examination of a specimen of Albodon was desired to check the findings in the laboratory.

According to the report of the microscopic examination, sodium perborate ($NaBO_3 \cdot 4H_2O$) was not found; whereas, borax to the extent of 5 per cent by volume was estimated. This is in agreement with the results obtained in the chemical examination, which indicated the presence of 5.5 per cent borax ($Na_2B_4O_7$) by weight.

Determinations were carried out for carbon dioxide and for chlorine by standard chemical methods. The amount of carbon dioxide evolved was equivalent to 54.4 per cent sodium bicarbonate, and the amount of silver chloride found was equivalent to 19.8 per cent of sodium chloride. The microscopic examination indicates the presence of from 3 to 5 per cent by volume of sodium chloride, but, in commenting on this finding, the report states: "Some difficulty was encountered finding sodium chloride. It was found that other finely ground material was sufficiently masking the optical properties." The chemical examination in this instance is taken as a more reliable criterion.

It is possible that sodium perborate may have originally been added to the mixture, but, in the process of manufacture, it is probably converted to borax. Fine grinding in the presence of moisture, which may be a part of the manufacture, may be responsible for the masking of the sodium chloride, and the final appearance of the borax instead of sodium perborate in the product as it reaches the consumer.

In any event, the claim that sodium perborate is an oxygen liberating cleanser as compounded in Albodon is not in accord with these findings. The further claim that "sodium bicarbonate" is "a neutralizer of acid products in the mouth" is untenable in view of the repeated biochemical observations that the acidity or alkalinity of the saliva cannot be materially altered by induced substances.

What is meant by the statement that "Albodon is a nearly completely *soluble* powder" is difficult to understand in view of the circumstance that chemical examination indicates the presence of 13.2 per cent of an acid-insoluble substance, kaolin.

GUM COPAL SOLUTION FOR CAVITY LINING AND VARNISH*

By SAMUEL M. GORDON, Ph.D., Chicago, Ill.

Various resins, natural or synthetic, dissolved in common organic solvents have been used as cavity varnishes and cavity linings. Most of these are secret in composition and covered by proprietary names. The cost to the dentist is generally large, the average price being about $2 for one-half ounce.

The resinous products that have been used are rosin (colophony), gum dammar, gum mastic, guttapercha, gum copal and certain synthetic resins of more or less unknown composition. Some of these have been compounded with frank medicinal agents (Copalite with chlorobutanol) and sold with medicinal claims. Little exact information concerning the composition or the relative worthiness of the various proprietary products is available. On the other hand, in the dental literature, recipes for such products may be found. Gum copal solution appears to be widely used. The purpose of this report is to point out the simplicity and the economy involved in preparing a solution of gum copal in chloroform for the purposes mentioned in the title.

Gum copal is a common article of commerce. It is widely used in the varnish industry for the manufacture of varnish and in the electrical industry as an insulating medium. Apparently, no generally acceptable standards or specifications for gum copal have been published.

A survey of the literature indicates that so-called gum copal used in varnish manufacture is not a single substance. The proximate analyses that have been reported vary over wide limits for such identifying constants as saponification number, iodine number and melting point.

Gum copal sets to a hard, varnish-like film. It is insoluble in water and partly soluble in most organic solvents. Because of its electrical insulating properties, it has been widely used as an insulating medium. Gum copal may be obtained at drug houses or paint supply stores.

Aiguier (D. Cosmos, 75:1184 [Dec.] 1933) has published a recipe for the preparation of a chloroform solution of gum copal for dental varnish purposes. His method consists in heating the resin until all volatile matter has been driven off, and dissolving the resulting residue in an appropriate solvent (chloroform and alcohol). This simple method of preparation can be used by the dentist.

This preparation of the product, which is analagous to the varnish makers' method, appears to be an unduly drastic process, since no directions have been given by Aiguier for the length of time of heating and the temperature of heating. Varnish makers generally heat the resin in pots to approximately 600 F. The disadvantage of this method is that it is apt to leave a burnt-varnish odor. Consequently, another method was tried.

Gum copal of commerce (25 gm.) was finely ground, mixed with an equal weight of white sand, placed in a Soxhlet extractor and extracted with chloroform. The sand is necessary to provide easy drainage through the resin. This should yield approximately 60 per cent of chloroform-soluble material. The insoluble portion is a gummy, sticky substance, which is discarded.

The chloroform soluble portion is treated with sufficient chloroform to make 100 c.c. The turbidity which develops is overcome by shaking with 5 gm. of powdered talcum, and filtering. This yields a concentration of gum copal of about 15 gm. per hundred cubic centimeters. This solution is further diluted with chloroform to a 2, 3 or 4 per cent

*Contribution from the A.D.A. Bureau of Chemistry.

solution. Dilute solutions appear to be preferable because of the thinness of the films. The slight turbidity that appears on dilution may be cleared up by shaking once more with talcum powder and filtering.

A film of such a 2 per cent solution, spread on a glass slide, hardens in a short while so that it cannot be appreciably marred by scratching with the finger nail or by light scratching with a steel instrument.

No other tests have been made. The foregoing comments are offered in response to many requests for cavity varnish and lining that have come to the A.D.A. Bureau of Chemistry.

Tooth Pastes and Tooth Powders

Tooth pastes and tooth powders have had the benefit of extensive advertising. Some of the claims for germicidal efficiency and ability to dissolve mucin have been greater tributes to the romantic tendencies of the writers of advertising copy than to the veracity of the manufacturers. Early in 1930 the American Dental Association, through the then recently organized Council on Dental Therapeutics, undertook to place the advertising of dentifrices on a more truthful and rational basis. Their viewpoint of the ability of tooth pastes and tooth powders to destroy germs is indicated by the fact that no dentifrice, for which bactericidal or therapeutic claims are made, is on the accepted list. Conservative dentists hold that if a dentifrice is effective at all it is primarily due to the friction between the teeth and the brush with the aid of the tooth paste or powder, and that the substances contained in the dentifrice are only of negligible importance. Certain manufacturers have claimed superiority of their products upon the basis that they materially lower the surface tension and therefore are more efficient. It does not necessarily follow that a substance possessing low surface tension is the most effective in cleansing, and it is especially dubious in the case of tooth pastes where various abrasive substances are incorporated in the pastes. Gordon and Shand found that tooth pastes could be divided into two groups upon the basis of the surface tension of their solutions: those containing soap and which produced a low surface tension, and those which did not contain soap and did not appreciably lower the surface tension. They found little difference in the degree to which the various soap-containing tooth pastes lowered the surface tension. In this connection it is interesting to note that the surface tension of a 5 per cent soap solution is lower than that of any tooth paste tested. Tooth pastes, in general, contain an abrasive, such as calcium carbonate or some form of calcium phosphate (tricalcium phosphate, calcium pyrophosphate or dicalcium phosphate). Some contain, in addition, magnesium hydroxide which is added as milk of magnesia; soap, orris root and potassium chlorate; astringents, such as zinc chloride; various phenols and other germicides. These are mixed in paste form with the aid of water, glycerin or glycerite of starch; gums, such as tragacanth, and flavored with sugar, saccharin and volatile oils. Of these ingredients, only a few can possibly be considered as possessing germicidal ability. When one considers the dilution and relatively short period of contact under the conditions of actual use, it seems impossible that any nontoxic paste could be capable of exerting germicidal action. Just how ridiculous it is to assume that they are capable of destroying bacteria can only be appreciated when it is known that the manufacturer of a popular antiseptic actually incorporated 1 part of the active germicidal substance in each 1,000 parts of tooth paste. The antiseptic, in this instance, is of such a nature that the presence of organic matter or particles of any kind greatly reduces its action. Considering that in actual use it will be greatly diluted, the antiseptic added to the tooth paste should be considered as a christening rather than as an antiseptic agent.—E. C. McCulloch in "Disinfection and Sterilization."

BUREAU OF PUBLIC RELATIONS

AN ORGANIZATION OUTLINE FOR A COMMUNITY DENTAL PROGRAM

By HARRY STRUSSER, D.D.S., and J. A. SALZMANN, D.D.S., New York City

A DEFINITE structural organization and functional analysis of the community dental program are perhaps more important to its successful consummation than any single factor. A basic plan is invaluable, not only because it gives definite scope to the work to be performed, but also because it helps eliminate visionary ideas that creep into community dental programs through the overzealous activities of interested and otherwise helpful persons. The outline here presented may be adapted for use in communities of any size and of varying economic stratums. It may be of service where community dental programs are already in existence in extending and correlating such programs. Community dental programs need not necessarily be confined to children, but may also be extended to adults. We shall consider here the community dental health program for children, since it has been shown many times that the greatest value to the community from the financial and health standpoints can be obtained by concentrating on the dental care of the child. The preschool and kindergarten to grade 4B should come first, although the program may be extended to include adults, if desired.

THE DENTAL OFFICER

The dental officer shall be an employe of the department of health. He may be a director of a bureau in the department of health or the chief of a dental division in a bureau; e.g., a bureau of school hygiene, which includes medical as well as dental care, hygiene and health education of the child. If the dental health officer is a director of a bureau, he is responsible to the head of the health department, usually known as the commissioner of health, chief public health officer or director of the department of public health. Where the dental health officer is the chief of a division, he is in turn responsible to the director of the bureau of which his division is a part. The dental health officer is the administrator, technical supervisor, organizer and coordinator. In addition, in small communities, he may also act in the capacity of field worker. In larger communities, he has a supervisory staff, which acts in the capacity of field workers or district dental health officers in the conduct of the community dental program. The district dental health officers may have their headquarters in a public school or in a neighborhood health center. Success or failure of the community dental program rests on his shoulders. The duties of the dental health officer bring him in contact with the following:

1. He is responsible to his superior in the department of health, of which he is an employe, as mentioned above.
2. He receives advice from the dental

advisory board and from the general health advisory board, where such a board is in existence, and of which he is also an ex-officio member.

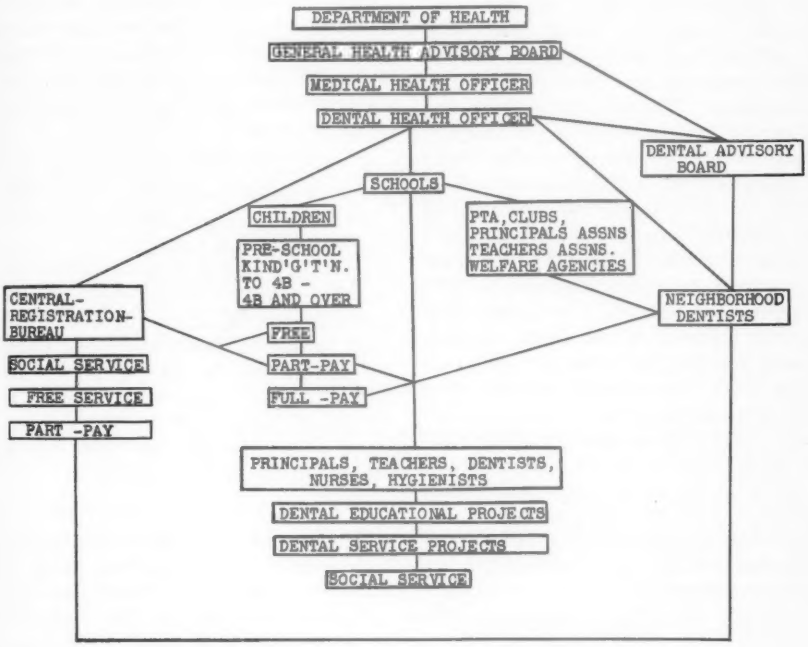
3. He advises and cooperates with the central registration bureau in the matter of social service investigation and the referal of free and part-pay patients to private dentists or to existing voluntary or tax-supported clinics.

4. He cooperates with school authorities, parent-teacher associations, mothers' clubs, welfare associations and civic clubs, in supplementing the official activities of the community dental program.

5. He plans the program and supervises the technical personnel engaged in carrying on the clinical and educational dental health program in the community.

6. He incorporates the instructions of the dental advisory board in his program and cooperates with the neighborhood dentists in their participation in the community dental program.

7. He acts as dental advisor to the medical health officer.



ORGANIZATION OF A COMMUNITY DENTAL HEALTH PROGRAM

GENERAL HEALTH ADVISORY BOARD

General health advisory boards should include in their membership representatives of the dental profession, in addition to physicians, representatives of educational, governmental civic organizations, health workers and interested laymen. The general health advisory board acts, as its name implies, in an advisory capacity on community health matters. It

aids in obtaining budgetary appropriations pertaining to the community dental health program.

DENTAL ADVISORY BOARD

The dental advisory board should include the dental members of the general advisory board and may consist of additional representatives from district dental societies and from other established geographic community subdivisions. The dental advisory board members may, in turn, be the chairmen of local dental subcommittees. The board may plan and supervise the apportionment of free and part-pay patients among dentists in the various neighborhoods where no facilities exist for the treatment of these classes of patients through the tax-supported dental program. It may act or designate committees to adjust complaints between patients and dentists. The appointment of the members of the dental advisory board may originate from groups of dentists in the various neighborhoods or in the local dental societies, who might submit such names to the commissioner or director of public health. This board outlines the scope, professional standards and procedures of the dental program. It recommends and aids in the establishment of the dental budget and in obtaining budgetary requirements.

CENTRAL REGISTRATION BUREAU

Central registration bureaus exist, as a rule, for the purpose of providing social service investigation for the hospitals and clinics in the community. In decisions as to eligibility for free or part-pay dental service, these bureaus may be of invaluable assistance because of their accumulated records. They may also assist in the referal of free or part-pay patients to designated private dentists or to available clinics in hospitals, dispensaries, clubs, settlements, etc., and private clinics under responsible auspices and partly supported by community funds.

SCHOOL AUTHORITIES

The school authorities, in cooperation with the dental health officer, form the backbone of the dental health program. A principal who is alert to the health value of dental care is an important asset. Teachers, dental hygienists, hygiene teachers, nurses and others are necessary to the successful conduct of the dental health education program and for the purpose of supplying necessary social service information.

PARENT-TEACHER ASSOCIATIONS

Parent-teacher associations and other civic bodies can participate in the community dental health program by cooperating with the dental health officer in providing funds and facilities for free dental care to supplement the services offered by official health bodies and those volunteered by the dental profession. These bodies may also act as avenues for the dissemination of dental health educational information, through either health talks or dental health exhibits.

THE SCHOOL DENTAL PROGRAM

The school dental program consists of: (1) dental health educational projects and (2) examinations, referal, operative service and follow-up.

Every child is examined by the dental hygienist or the school dentist. If in need of dental service, he is referred to his private dentist. If the child cannot afford to pay current private dental fees, he is referred to the central registration bureau or other designated agency, where he must satisfy definite social service requirements. These requirements having been satisfied, the child is referred to one of the dentists in his neighborhood who has agreed to render part-pay or free service to school children or to the original den-

tist who made the examination if he has expressed an intention to render part-pay service. Where tax-supported facilities are available, the child who cannot afford to pay is referred to these for free service; while part-pay patients are referred to private dentists who have agreed to render such service at fees commensurate with the ability of the patient to pay. Clinics established in schools should be confined to poorer neighborhoods. It is a good policy to provide large reception room space, which may be used for expansion of clinical facilities when desirable. Each dental chair can care for from 300 to 350 children during one year, or 1,000 hours of actual service annually.

NEIGHBORHOOD DENTISTS

The dentists in the various neighborhoods can cooperate with the official public health authorities in the conduct of educational programs, in providing part-pay service and, where feasible, in the provision of free service. In order to prevent patients in any community from comparing part-pay with regular dental fees, it has been suggested that the part-pay patient be told that the fee represents only part payment for the work needed, according to an arrangement with the health department. Part-pay patients can be treated on a "mouth unit" basis rather than on a "per filling" basis, to prevent fee comparisons by patients.

CONCLUSION

Dental health education is an important phase of the community health program and should be correlated to the grade of the children and to the average educational level of the audience to be reached.

949 Broadway.

576 Fifth Avenue.

A PRACTICAL DENTAL HEALTH EDUCATIONAL PROGRAM

BECAUSE of the numerous requests received by the Bureau of Public Relations from educators, public health nurses and dentists for an outline for teaching dental health, the following has been developed.

In presenting this outline, it is not presumed that it is the only procedure that can be followed. Many communities have developed dental health programs that have proved highly successful in their schools.

This outline is based on dental educational material that can be secured from the Bureau of Public Relations of the American Dental Association.

REASONS FOR ESTABLISHING A DENTAL HEALTH EDUCATIONAL PROGRAM

It is not necessary to elaborate on the need of a school dental health educational program. Dental decay is one of the most prevalent, if not *the* most prevalent of childhood diseases. Over 90 per cent of American children suffer from oral defects.

Dental disease and its serious sequelae can and frequently does injure the child's health, retard his school progress, cause him unnecessary pain, permanently affect his behavior and increase personal and community economic expense.

A large percentage of dental disease,

together with its attendant ills, can be prevented, provided preventive measures are inaugurated early in life.

THE FOUNDATION OF PREVENTIVE DENTISTRY: EDUCATION

The elementary schools, particularly the kindergarten and primary grades, offer the best opportunity for the application of dental preventive measures. Children in these grades can be given inexpensive group instruction; also, they are so young that they will profit from most of the benefits of a preventive dental program.

Most modern educational systems include in their curriculum the teaching of health, including some instruction in dental health. Modern educators welcome the opportunity to improve the health as well as the mind of the pupil and they are anxious to include in the curriculum the latest and most efficient health-teaching methods. Boards of education, school superintendents and teachers appreciate the importance of preventive dentistry and the value of dental health education. The big problem is to assemble authoritative dental educational material and to find ways and means of including it in an already overcrowded curriculum. This outline solves the former problem and helps solve the latter.

SCOPE OF DENTAL HEALTH PROGRAM

To be successful, the school dental health program must be based on education. In the past, too much time, energy and money have been spent on clinical procedure and not enough on teaching children preventive measures.

It is suggested that the school dental health plan consist of:

1. Annual or semi-annual dental examinations and notification of parents.
2. Monthly inspection of teeth for cleanliness and notification of parents.
3. Classroom education by each room teacher.
4. Special or assembly lectures once a month or at least four or five times a year by the dental supervisor.

In general, the dental educational program should be built around:

1. Proper diet for building and maintaining good teeth.
2. Regular dental attention.
3. Cleanliness.

THE DENTAL SUPERVISOR

To be successful, the dental health program should be in charge of one competent person, who may be a full-time or part-time employe of the school, or, in an emergency, a volunteer worker. This person may be a dentist, dental hygienist or nurse who has had, besides technical education, some special training in pedagogy. Or the supervisor may be, in cases of necessity, one of the teachers who possesses a good understanding and some training in the field of dental health. In any event, one person should be charged with the responsibility of carrying on the program.

DENTAL EXAMINATIONS

A complete and systematic dental examination of the children promotes the success of a school dental program; but school examinations are valueless unless they are followed up with good educational material.

If possible, the examinations should be so made and recorded that a complete dental history will be had of each child from kindergarten until graduation from high school. Such records enable the school authorities to note the dental improvement and compare it with the scholastic progress.

Dental examinations can best be made in the offices of the family dentist, because

the facilities, lighting, etc., are usually the best obtainable. For the sake of clarity, we may call this a type A examination.

Sometimes a community prefers to have the dental examinations made in the school rather than send the children to the dentist's office. We may call this a type B examination.

If a type A examination is made, the procedure is usually as follows: The teacher gives each child an examination card, which is properly filled out with name, address, school, grade, etc. She instructs the child to go to the family dentist (accompanied by parents or guardian) for an examination. It is essential for the parent or guardian to accompany the child that the dentist may explain to them what corrections are needed. The dental findings should be tabulated on the examination card, which is signed by the dentist and returned by the child to the teacher, who should then do her utmost to persuade the child and the parent to have all necessary corrections made. The teacher should keep a record of the dental findings in each case. The names of the children with no defects can be displayed on the blackboard or on an honor roll in one corner of the room. As soon as each child has his defects corrected, his name is placed on the honor roll. After the teacher has made a list of the children and their dental defects, she should forward all examination cards to the board of education office, where they can be tabulated. Thus, the school authorities will know how many children in the school system have defective teeth. At the end of the school year, the teachers can send in a report to the central office as to how many children have had their defects corrected. Thus, the school authorities can determine the result of the dental educational program.

If a type B examination is made; that is, if the examination is made in the schools by the local dentists or by the school dentist or hygienist, the parents should be notified to be present at the time of the examination that they may be informed regarding the child's dental condition. The type B examination has some advantages and some disadvantages over the type A method.

Advantages of Type B Over Type A.—1. Every child in school is examined. 2. The entire school population can be examined quickly and easily because the examiners are brought to the children.

Disadvantages of Type B Over Type A.—1. Examinations cannot be so thorough. 2. All parents will not be present. 3. Classes are disrupted.

In type B examinations, two sets of cards should be used for dental examinations because:

1. Each child should have an examination card on which his dental findings can be recorded. This card should remain in the school.

2. Each child needing dental care should be given a parent-notification slip advising the parent in general terms that dental corrections are necessary. (The detailed findings should not be sent home as it may lead to misunderstanding between the parent, the examining dentist and the family dentist.) After the children in each room are examined, the teacher should do her utmost to persuade the parent and child to have the child's dental defects corrected.

From this point on, procedure in type B examination is the same as in type A examinations.

Regulation dental examination cards can be secured from the Bureau of Public Relations, American Dental Association, at 75 cents per hundred.

FOLLOW-UP OF EXAMINATIONS

Intelligent follow-up of school examinations is most necessary to secure good

results. The examination itself is only a preliminary move in the entire school dental health program.

SUGGESTIONS FOR FOLLOW-UP BY THE TEACHERS

The success of teaching dental hygiene in the school depends largely on the interest and enthusiasm of the classroom teacher.

Each teacher can keep the children interested in the care of the teeth by:

1. Maintaining a dental honor roll. As soon as a child has all dental defects corrected, his name is placed on the roll.
2. Including teeth inspection in the daily hygiene inspection.
3. Insisting that every child have and use a toothbrush.
4. Including short lessons on dental health as often as is practical.
5. Once a month, inspecting each child's teeth for cleanliness and including a report of findings on the child's monthly report card, which is taken home by the child to be signed by the parent.
6. Giving the child a dental certificate for mouth cleanliness.
7. Giving the child a button if the teeth and mouth are free of infection and the cavities filled.

SUGGESTIONS FOR FOLLOW-UP BY THE DENTAL SUPERVISOR

In addition to the dental health instructions given by the classroom teacher, who may be equipped with the materials listed at the end of this outline, the dental supervisor can do an excellent piece of follow-up work by giving the children monthly or bimonthly lectures either in the classroom or during assembly periods. These may be motion picture or stereopticon slide lectures or they may be chalk talks on different phases of mouth health.

The following motion pictures are suggested for use:

Kindergarten and first four grades:
- Life of a Healthy Child.
- Bobby's Bad Molar.

Fifth to eighth grades:
- Tommy Tucker's Tooth.
- Tommy's Troubles.
- Life of a Healthy Child.
- Ask Your Dentist.

High school:
- How Teeth Grow.
- Care of the Teeth.
- Nature, Builder of Teeth.
- Life of a Healthy Child.
- Ask Your Dentist.
- Your Mouth.

The following lantern slide lectures are suggested for use in the different grades:

Kindergarten and first to fourth grade:
- Every Child's Treasure (31 slides).
- The D. Kay Brownies (10 slides).

Fifth to eighth grade:
- The Teeth and Their Care (12 slides).
- Your Teeth (40 slides).
- Johnny Don't Care's Teeth (22 slides).
- Nature, Builder of Teeth (17 slides).

High school:
- The Tooth Question (42 slides).
- The Mouth and Its Message (13 slides).
- Pyorrhea (2 slides [six illustrations per slide]).
- The Talking Tooth (2 slides [six illustrations per slide]).
- Nature, Builder of Teeth (17 slides).

The motion pictures and stereopticon slides listed above can be rented from the Bureau of Public Relations, American Dental Association. Other slides on practically every phase of dental health can be secured from the same source.

MONTHLY MOUTH INSPECTION FOR CLEANLINESS

If the school population is not too large, the dental supervisor can make the monthly mouth cleanliness inspection and thus relieve the teacher of this phase of the program. The mouth inspection can be made at the same time that the monthly dental lecture is given. Thus, the dental supervisor will spend from twenty to thirty minutes every month with each class.

ADDITIONAL ACTIVITIES OF THE DENTAL HEALTH SUPERVISOR

The dental supervisor, assisted by the classroom teacher and other teachers, can have one or more groups of children present a dental health playlet once a year. This should be shown to all children in the school and to the parent-teacher association and other adult groups as well. Dental health playlets can be secured from the Bureau of Public Relations, American Dental Association.

The dental health supervisor can:

1. Give, or arrange to have given, a dental health lecture once or twice a year to each of the community civic organizations such as the Rotary, Kiwanis, Lions and women's clubs.
2. Take charge of the annual or semi-annual dental examinations.
3. Make necessary home calls in cases that require special attention.
4. See that rooms are supplied with dental honor rolls.
5. Permit each room in which the children have had all dental defects corrected to have a dental poster contest.
6. Give each child who has his teeth cleaned, all cavities filled and all infection eliminated a dental button.
7. Give each child who keeps his teeth clean for a certain period of time an individual dental certificate.
8. In general, create and maintain community interest in school dental health education.

DENTAL HEALTH EDUCATIONAL COMMITTEE

In many communities, the school authorities appoint, and profit by the advice of, a dental health educational committee. This committee may be composed entirely of members of the dental profession or it may include representatives of the various community organizations that are interested in health and civic affairs.

If properly organized and encouraged, this committee can be of inestimable value to the school authorities in matters of dental health. It can:

1. Supply the school with the necessary dental health books, pamphlets, charts and other material, listed in this outline or from other sources. (The small amount of money necessary for this material can be contributed by the parent organizations which the committee members represent.)
2. Arrange for the parent organizations to set aside one meeting a year to be devoted to dental health.
3. Each year, present individual dental certificates to every child who, on graduation, is free from dental defects.
4. Assist the dental supervisor in conducting a dental poster contest.
5. Develop new ways and means of keeping the children, the school and the parents interested in the program.

The program outlined above can be conducted by any community at very little expense. By combining their efforts, the school, the dental society and the various civic groups can easily defray the cost of materials needed. The success of the program will depend on the enthusiasm, interest and spirit of cooperation and perseverance developed and maintained by its sponsors.

Literature citing the needs and the de-

sirability of an adequate dental health educational program includes:

Mouth Hygiene, by A. C. Fones, Philadelphia: Lea & Febiger; price $5.

Health Dentistry for the Community, University of Chicago Press, price $1.

Report of the Committee on Public Dental Education of the St. Louis Dental Society for 1933.

School Dental Service Package Library, Library Bureau, American Dental Association.

REFERENCE BOOKS ON DENTAL HEALTH FOR ALL TEACHERS

Urling, L. H.: Your Teeth; Their Care and Preservation, Dorrance Publishing Co., $1.50.

Hyatt, T. P.: Hygiene of Mouth and Teeth, Brooklyn Dental Publishing Co., $1.00.

Adams: Your Teeth and Their Care, C. V. Mosby Co., $1.25.

Burkhart, H. J.: Care of the Mouth and Teeth, Funk-Wagnalls, $0.30.

Fones, A. C.: Preventive Dentistry, Lea & Febiger, $2.75.

Fones, A. C.: Mouth Hygiene, A Text Book for Dental Hygienists, Lea & Febiger, $5.00.

Head, Joseph: Everyday Mouth Hygiene, W. B. Saunders Co., $1.00.

Hartman, L. A.: Teeth and the Mouth, D. Appleton, $1.50.

DENTAL HEALTH EDUCATIONAL MATERIAL FOR DIFFERENT GRADES

Kindergarten, First and Second Grade Material

Books

Towse & Gray: Health Readers Book No. 1, Scott Foresman Publishing Co., $0.60.

Mathews & Gray: Health Readers Book No. 2, Scott Foresman Publishing Co., $0.68.

Andress: A Journey to Health Land, Ginn & Co., $0.76.

Andress: The Boys and Girls of Wake Up Town, Ginn & Co., $0.76.

Herben: Jack O'Health and Peg O'Joy, Scribners, $0.45.

Pamphlets, Posters, Charts, Certificates, Etc.

Dorothy Dot and Dorothy Dod and Other Dental Rhymes, $0.05.

A Sad Story of Mary Suck Her Thumb and Other Stories, $0.05.

Toothsome Stories, $0.05.

The Story of the Food Chopper, $0.05.

The King's Soldiers, $0.05.

First grade educational leaflets for reading and coloring, 1 set of 6 leaflets, 5 cents; 35 sets of leaflets, $0.75.

Tooth Brushing Chart, $0.25.

Care of the Teeth Booklet (quantity prices on request; single copy, $0.10.

How to Build Sound Teeth (booklet), $0.03.

4 dental health posters (colored), $1.00.

Dental Examination Charts (per hundred), $0.75.

Mickey House Honor Roll.

Mickey Mouse Individual Dental Certificates for Clean Teeth.

Mickey Mouse buttons for children whose mouths are free from infection and decay.

Third and Fourth Grade Material

Books

Ferguson: A Child's Book on Teeth, World Book Co., $0.44.

Towse, Mathews & Gray: Health Reader No. 3, Scott Foresman Publishing Co., $0.76.

Turner & Collins: The Voyage of Growing Up (Malden Heath Series, Book 1), D. C. Heath & Co., $0.76.

Williams & Dansdul: Health and Happiness, B. H. Sandborn Co., $0.64.

Pamphlets, Posters, Charts, Certificates, Etc.

How to Build Sound Teeth, $0.03.

A Survey of Dental Diagnosis During Childhood (chart), $0.15.

A Practical Tooth Brushing Chart, $0.25.

Dental Examination Charts (per hundred), $0.75.

Happy Days with Jack and Joan (booklet for reading and coloring, quantity prices on request); single copy, $0.05.

Care of the Teeth Booklet (quantity prices on request); single copy, $0.10.

4 dental health posters (colored), $1.00.

Mickey Mouse Honor Roll.

Mickey Mouse individual certificates for clean mouths.

Mickey Mouse buttons for children who have no dental cavities or mouth infection.

Fifth to Eighth Grade Material

Books and Periodicals

Ferguson: Child's Book on Teeth, World Book Co., $0.40.

Mace & Goldberger: Broadcasting Health, Ginn & Co.,

Andress & Evans: Health and Success, Ginn & Co., $0.76.

Winslow & Hahn: New Health Living Book 1, Chas. E. Merrill & Co., $0.80.

Winslow & Hahn: New Health Living Book 2, Chas. E. Merrill & Co., $1.00.

Turner & Collins Community Health (Malden Heath Series Book 4), D. C. Heath & Co., $2.50.

Hygeia, American Medical Association (per year), $2.50.

Pamphlets, Posters, Charts, Playlets, Certificates, Etc.

Care of the Teeth Booklet (quantity prices on request); single copy, $0.10.

Children's Teeth, How to Use and Keep Them: Permanent Teeth, $0.03.

The Promotion of Health in the Mouth, $0.03.

The Masticating Machine, $0.03.

Set of 8 colored dental health charts, $1.00.

A practical tooth brushing chart, $0.25.

Answer Your Own Dental Question charts (quantity prices on request); single copy, $0.05.

Dental examination charts (per hundred), $0.75.

Dental Health Playlets:

Stepping Stones to Happiness, $0.05.

Bad Baby Molar, $0.05.

Grandfather Molar.

Sells Health-O Circus, $0.05.

Mickey Mouse Honor Roll.

Mickey Mouse individual certificates for clean teeth.

Mickey Mouse buttons for children having no dental decay or mouth infection.

High School Material

Books and Periodicals

McCollum & Simmonds: Food, Nutrition and Health, $1.50.
Women's Foundation for Health: Foundation of Nutrition, $2.75.
Fones, A. C.: Mouth Hygiene, Lea & Febiger.
Hygeia, American Medical Association (per year), $2.50.

Pamphlets and Charts

Clean Teeth as an Asset, $0.05.
The Care of Children's Teeth, $0.05.
A Constructive Program for Dental Health, $0.05.
The Teeth and Health, $0.05.
The Question of Foods, $0.05.
Scientific Feeding of Children, $0.05.
The Care of the Teeth Booklet (quantity prices on request); single copy, $0.10.
What It Means to Be a Dentist (by L. E. Blauch), $0.05.
How to Build Sound Teeth, $0.03.
What Is the Economic Value of Dental Health to the Community? $0.05.
Public Health Aspects of Vincent's Infection, $0.05.
Disease Conditions of the Mouth and Their Relation to Health, $0.05.
Set of 8 colored dental health educational charts, $1.00.
Answer Your Own Dental Question charts (quantity prices on request); single copy, $0.05.
Bödecker's pyraglazed enamel fissure decay chart, $0.30.
McCall's pyraglazed dental decay chart, $0.35.
Dental examination charts (per hundred), $0.75.

All of the books, pamphlets, charts and other literature listed in this outline are obtainable from the Bureau of Public Relations of the American Dental Association, 212 E. Superior Street, Chicago, Ill.

A.D.A. Radio Broadcasts Over Columbia Northwest Chain

Through the cooperation of the Columbia Broadcasting System, the American Dental Association's new series of radio programs, "Dental Customs of Primitive People," are being made available to the following stations:

WOC Davenport, Iowa
KRMT Des Moines, Iowa
KSCJ Sioux City, Iowa
KFAB Lincoln and Omaha, Nebr.
WISN Milwaukee, Wis.
WCCO Minneapolis and St. Paul, Minn.
WMBD Peoria, Ill.
WNAX Yankton, S. D.

The subjects and dates for the coming month are as follows:

December 1: Congo Dental Customs
December 8: Dental Conditions Among the South African Bantu
December 15: Teeth as Health Protecting Amulets
December 22: Dental Decorations Among the Incas, Mayas and Aztecs
December 29: Ancient Chinese Dentistry

A-1.—Models demonstrating value of roentgenogram in discovering interproximal decay and decay beneath filling.

A-3.—Models demonstrating value of roentgenogram in discovering presence of root fragments.

New Dental Health Models

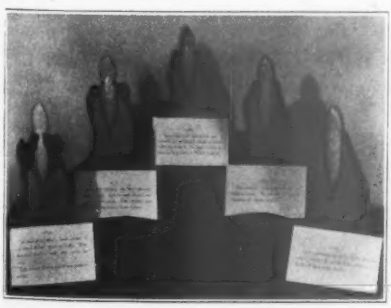
The five sets of models illustrated on this page are extremely valuable for lay educational purposes. They are constructed of plaster, beautifully colored, and are 12 inches high.

Set A-1 shows decay; A-2, the progress of pyorrhea; A-3, root fragments; A-4, impaction; A-5, results of loss of a tooth.

State and component societies may rent these for health weeks, fairs and other health demonstration purposes. Sets A-1 and A-2 combined rent for $3.00. Sets A-3 and A-4 combined rent for $3.00. Set A-5 rents for $3.00. All rental charges are on a weekly basis. The renter pays express charges to and from Chicago.

Address all requests to the Bureau of Public Relations, American Dental Association, 212 E. Superior St., Chicago, Ill.

A-4.—Models demonstrating value of roentgenogram in discovering presence and revealing condition of impacted teeth.



A-2.—Models demonstrating progress of pyorrhea.

A-5.—Models demonstrating changes that often occur after extraction of tooth.

DENTAL HEALTH EDUCATIONAL MATERIAL

Dentists will find some of this material excellent for their waiting room table, and for use at the chair in educating both parents and children. *Education is the basis of preventive dentistry.*

Hygienists, nurses, teachers and public health workers will also find that much of this material will assist them greatly in their health activities. *Education is fundamental in public health work.*

Make use of this dental health educational material—order by number—order blank is printed on page 2397.

PAMPHLETS ON MOUTH HEALTH

1. Children's Teeth—How to Use and Keep Them Pt. I (Deciduous Teeth)..... 3c
2. Children's Teeth—How to Use and Keep Them Pt. II (Permanent Teeth)..... 3c
3. How to Build Sound Teeth—Children's Teeth Pts. I-II (Prenatal)..... 3c
4. The Promotion of Health in the Mouth..... 3c

5a. Disease Conditions of the Mouth and Their Relation to Health..... 5c
(25 copies for 50c)

6. What Bacteria Do in the Mouth..... 3c

7a. Outline of Lectures for Nurses..... 5c

7b. Your Teeth and Your Baby's Teeth (a prenatal booklet)..... 5c
(25 copies for $1.00)

TALKS FOR LAY AUDIENCES

8. Clean Teeth as an Asset (For high school pupils)..... 5c
9. The Care of Children's Teeth (For adult audience)..... 5c
10. A Constructive Program for Dental Health..... 5c
11. The Teeth and Health (For adult audience)..... 5c

RADIO TALKS

(Subjects furnished on request)

12. *Series A.* Booklet containing twenty-two 15-minute talks covering a variety of dental topics..... 15c
13. *Series B.* Fifty 7-minute talks.....5c each—6 for 25c
13a. *Series C.* Thirty-nine 5- and 10-minute talks (approved by the A.D.A. and the U. S. Public Health Service).....5c each—6 for 25c
13b. *Series D.* Twenty-seven 12 to 15 minute talks in dialog form—Dental Customs of Primitive People, approved by the A.D.A. and the U. S. P. H. S.....10c per copy—entire set, $2.50

A BENEFICIAL PRODUCTION CIRCLE

PAMPHLETS ON NUTRITION

14a. "Scientific Feeding of Children," by Lydia J. Roberts..... 5c
15. "Practical Nutritional Suggestions for Dentists," by Percy R. Howe, D.M.D..... 5c

STORIES, PLAYS AND RHYMES

16. A Sad Story of Mary-Suck-Her-Thumb and Other Health Stories..... 5c
16a. Dorothy Dot and Dorothy Dod and Other Dental Rhymes..... 5c
17. Toothsome Stories..... 5c
18. The Story of the Food Chopper (for primary grades)..... 5c
19. The King's Soldiers (for primary grades)..... 5c
20. Stepping Stones to Happiness (dental playlet)..... 5c
20a. Bad Baby Molar (dental playlet)..... 5c

21. Grandfather Molar (dental playlet) 5c
22. Sells Health-O Circus (dental playlet) 5c

(Through the courtesy of the Illinois State Department of Health, the Bureau is enabled to offer the privilege of using the manuscript and staging properties for the very excellent dental health play entitled "Sells Health-O Circus." Information as to the conditions under which circus properties are obtainable may be secured on request.)

MISCELLANEOUS

23. "Achievements and Results in West Va. of the Jenkins-Jones Dental Dispensary and McDowell County Dental Clinic," by T. G. Epling, D.D.S. 5c
24. "Public Health Dentistry in Santa Barbara County," by Leo Mollath, D.D.S. 5c
25. "Dentistry in Public Health," by C. T. Messner, D.D.S. 5c
26. "Significance of Clinical Experience as Related to Prevention for the Child Patient," by Lon W. Morrey, D.D.S. 5c
27a. "What It Means to Be a Dentist," by L. E. Blauch, Ph.D. 5c
28. "What Is the Economic Value of Dental Health to the Community?" by Arnold M. Kegel, M.D. 5c
29. "Dental Health Week," by C. J. Hollister, D.D.S. 5c
30a. "A Practical Dental Health Educational Program." 5c
31a. "Answer Your Own Dental Questions" 5c
A revolving colored disk, superimposed on a 6x8 inch cardboard chart. It answers 24 common dental questions. Prices in quantity lots given on request.
32a. Pyraglazed 8½ x 15 McCall chart—Enlargements of Decay in First Permanent Molar .. 35c
33a. Public Health Aspects of Vincent's Infection, by J. M. Wisan 5c
34. "Facts Demanding Serious Professional Consideration as Disclosed by Dental Contact with the Committee on the Cost of Medical Care," by H. L. Phillips, D.D.S. 5c
35. "Proper Dental Care for the Child Patient," by T. A. Gardner, D.D.S. 5c
36. "The Preparation and Delivery of a Speech," by Bertram G. Nelson 5c
37. "Are Extension Courses a Success?" by J. B. Jenkins, D.D.S. 5c
38. "Prosthesis in Children's Dentistry," by F. B. Rhobotham, D.D.S. 5c
39. "Dental Internship in a General Hospital," by D. F. Lynch, D.D.S. 5c
40a. List of Hospitals Offering Dental Internships 5c
40b. Pyraglazed 9 x 16 inch Bodecker Chart 30c
(showing in colors the progress of dental decay.)
40c. Rhobotham Children's Dental Examination and Record Cards ..... 75c per 100
40d. The Mouth Is a Gateway of Infection, 5 x 7 inch chart. Drawing showing how good mouth hygiene reduces the danger from disease ..... Sample copy 1c; 50c per 100 copies

NEWSPAPER ARTICLES

BENEFICIAL PRODUCTION CIRCLE

41. "John, Mary & Jack," a series of 52 short semicontinued newspaper stories, approved by the American Dental Association and the U. S. Public Health Service. Prepared for insertion in your local newspaper ..... No charge

MICKEY MOUSE MATERIAL

42a. Mickey Mouse dental health buttons .....
42b. Mickey Mouse dental health certificates .....
42c. Mickey Mouse honor rolls .....
44. *"A Survey of Dental Diagnosis During Childhood"* Chart 15c

A BENEFICIAL PRODUCTION CIRCLE

45. A PRACTICAL TOOTHBRUSHING CHART

A 21 by 27 inch chart. Printed on heavy paper and securely tinned at top and bottom.....Single copies, 25c. In lots of 25 or more, 20c.

PRACTICAL TOOTH BRUSHING AND HABIT FORMING CHART
There are five surfaces of every tooth to brush: the grinding or chewing surface, the outside or cheek surface, the inside or tongue surface and the two surfaces in between. A toothbrush will not clean where it does not touch. Clean the teeth at least twice a day. Use a good, small toothbrush and a good dental cream or powder. Help build strong teeth by eating the right food, such as milk and other dairy products, vegetables, fruit, whole grain bread and cereals, meat and eggs; also eat some course food to exercise the teeth and gums. Play outside each day; sleep at least ten hours each night; visit your dentist at least every 4 to 6 months.

46. MOTION PICTURE FILM SERVICE

Dental educational films are available in both 35 m.m. and 16 m.m. stock. These may be rented for $1.00 a day or $3.00 a week, plus shipping charges both ways. Charge is made for each day of use before an audience, but no charge for time in transit. The renter is held responsible for injury to films. *In requesting films, please state the ones desired, when desired and for how long.* Following is a description of the films available:

"Your Mouth" (35 m.m.), 15 minutes. Synopsis: Gives cause, progress and results of tooth decay; methods of prevention; brings in nutritional aspect, use of roentgen rays, brushing, etc. Suitable for high school and adult audience.

"Tommy Tucker's Tooth" (35 m.m. and 16 m.m.), 15 minutes. Synopsis: The "Tell-a-Story-Lady" narrates to a group of children the importance of keeping teeth in good condition. Animated scenes used effectively.

"Clara Cleans Her Teeth" (35 m.m. and 16 m.m.), 15 minutes. Synopsis: Clara, aged 10, always neglected her teeth until she learned, through her playmates, the importance of daily brushing and care. Interesting story which impresses lesson effectively.

"Tommy's Troubles" (35 m.m.), 20 minutes. Synopsis: On oral hygiene. Emphasizes importance of diet as well as cleanliness in care of teeth; shows proper method of brushing them.

"Bobby's Bad Molar" (35 m.m. and 16 m.m.), 15 minutes. Synopsis: Bobby has neglected his teeth and is paying the penalty by doing poor work in school, being backward in athletics, etc. One day his teacher sends him to the school dental hygienist, who examines his teeth. The hygienist explains Bobby's teeth troubles to him and urges him to go to the dentist at once and receive attention. Bobby takes her advice and finally becomes an enthusiastic advocate of the proper care of teeth.

"Life of a Healthy Child" (16 m.m.), 15 minutes. Synopsis: Illustrates healthful activities of a normal school child. Habits of cleanliness, correct diet, carefree play, visits to dentist and physician are emphasized. Excellent for parent-teacher groups or child audiences.

"Ask Your Dentist" (35 m.m. and 16 m.m.). Excellent for high school and adult groups. Stresses the importance of diet, cleanliness and dental attention. A touch of humor is added by the use of cartoons.

"How Teeth Grow" (16 m.m.), 15 minutes. Synopsis: Eastman classroom film for health education. Shows in interesting and instructive manner growth and development of temporary and permanent teeth. Demonstrated through use of animation, models, and subjects of various ages. (For children and adults.)

"Care of the Teeth" (16 m.m.), 15 minutes. Synopsis: Eastman classroom film for health education. Shows various phases of care of teeth such as diet, care by dentist, brushing and home care. Useful in giving fresh support to activities of dental hygiene program. Designed for individuals above fourth grade.

Technical Film: *"The Physiology of Mastication"* (16 m.m.); 2 reels. Synopsis: Study of jaw movements of various animals exhibiting types of mastication as an introduction to study of human beings. Animated skulls and cartoons are synchronized with mandibular movements of animals. The film shows that "three point contact" and "bilateral balanced occlusion" never occurs in lower animals during process of incising and chewing tough resistant food.

Technical Film: *"Mechanics of Balance in Dental Prosthesis"* (16 m.m.); 1 reel. Synopsis: Depicts clinical application of unilateral balance to prosthetic dentistry. Film is a continuation of the above-mentioned film, *"The Physiology of Mastication."*

Technical Film: *"Uses of Gelatin in Dental Arts"* (16 m.m.); 2 reels.

"Nature—Builder of Teeth" (16 m.m.); 1 reel shows the development of teeth from birth to adulthood. Explains the part played in facial development by the erupting forces of teeth; also effect of nutritional disturbances and illness on tooth development; mottled teeth, normal and abnormal occlusion, are portrayed. Written lecture accompanies film. Can be purchased for $25.00, or rented for usual rental fee.

47. LANTERN SLIDE SERVICE

Lantern Slide Lectures:

"The Tooth Question," lecture (for adult audiences); 42 slides. (Requires one hour to present.)

"The Mouth and Its Message," lecture (for adult audiences); 13 slides. (Requires thirty minutes to present.)

"Every Child's Treasure," lecture (for school children of first six grades); 31 slides. (Requires thirty minutes to present.)

"The D. Kay Brownies," lecture (for school children of first four grades); 10 slides. (Requires twenty minutes to present.)

"The Teeth and Their Care," lecture (for school children of fifth to eighth grades); 12 slides. (Requires about thirty minutes to present.)

"Your Teeth," lecture (for school children of fifth to eighth grades); 40 slides. (Requires about one hour to present.)

"Pyorrhea," lecture (for adult audiences); 2 slides (with six illustrations per slide). Requires about fifteen minutes to present.

"The Talking Tooth," lecture (for adult audiences); 2 slides (with six illustrations per slide). Requires about fifteen minutes to present.

"Nature, Builder of Teeth," lecture (for adult audiences); 17 slides. (Requires about thirty minutes to present.)

Note: Copies of the foregoing lectures are furnished free, although a small rental fee is charged for the slides (see lantern slide service).

"Johnny Don't Care's Teeth" (for fourth to eighth grade children); 22 colored slides. Self-explanatory; no written lecture necessary.

"Prevention of Dental Decay" (for adult audiences); 33 slides. (Requires about forty minutes to present.) Covers teeth development, anatomy, diet, cleanliness, dental attention, progress and results of decay, pyorrhea, and Vincent's infection.

Lantern Slide Rental Service:

The Bureau has a large collection of slides (standard size, 3¼ by 4 inches) suitable for professional and lay groups. A complete list of these slides will be furnished on request. Any selection of slides may be rented on the basis of $1.00 a day or $3.00 a week, plus shipping charges both ways. No charge is made for time in transit or time spent in review. In request-

ing slides (provided you do not order from our list), please state the topics that you desire to cover, type of audience, number of slides, when wanted and length of time desired. The renter is held responsible for all breakage.

Lantern Slide Sales Service:

The Bureau will sell duplicates of any stock slides at the following prices: plain slides, 35c each; colored slides, 75c each. On request, the Bureau will prepare slides from photographs or cuts on the following basis: *plain slides:* negative, 25c; slide, 35c; making total cost for each original slide 60c; *colored slides:* negative, 25c; slides, 75c; making total cost for each original slide, $1.00. *Remittance must accompany all orders.*

A BENEFICIAL PRODUCTION CIRCLE

48. FIRST GRADE DENTAL EDUCATIONAL LEAFLETS

GO TO THE DENTIST AT LEAST TWICE A YEAR

The dentist is my friend.
He helps me to have nice teeth.
I go to see him often.
Sometimes teeth have little holes in them.
If there are little holes in my teeth
the dentist will fill them.
He will help me to keep my teeth clean.

BRUSH YOUR TEETH TWICE A DAY

Here are our teeth brushes.
They are hanging in the sun.
The brushes are all small.
They have pretty colored handles.
The one with the yellow handle belongs to my mother.
The one with the green handle belongs to my father.
The one with the blue handle belongs to my sister.
The one with the red handle belongs to me.
I brush my teeth every night.
I brush my teeth very morning.

TOOTH BUILDING FOODS

Milk helps to build strong teeth.
Dark bread helps to build strong teeth.
Dark cooked cereals are good foods to build teeth.
I eat cereal and milk for my breakfast.
I sometimes have toast for my breakfast.
My teeth need milk and cereals.

Six leaflets designed for first grade dental education (three of which are shown). Each lesson is printed on 8 by 11 inch drawing paper. The wording is fitted to first grade vocabulary. The text is scientifically correct. The drawings are simple and artistic. After each lesson is learned, the drawings are to be colored by the child. They enable educators to coordinate the teachings of dental health with that of art and reading.

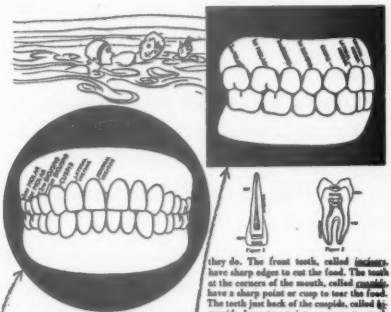
One set of six leaflets, 5 cents. Twenty-five sets of leaflets, 50 cents.

49. FOURTH GRADE DENTAL EDUCATIONAL BOOKLET

Jack and Joan are twins. They were twelve years old their last birthday. They have never had a single day of sickness. People who know them say they are the peppiest and liveliest children in town. They are never idle a minute. In the summer, they love to swim, ride and play tennis. In the winter, they enjoy skating, coasting and skiing. They are as happy and healthy as twelve year old children can possibly be. Both the winter and summer months are crowded with happy days for Jack and Joan. There are several reasons for these happy days which they learned from Uncle Dan. One of these reasons is told and pictured on the inside pages of this book. Color the pictures with crayon or water colors as you read the story of Happy Days.

Approved by
THE AMERICAN DENTAL ASSOCIATION and the UNITED STATES PUBLIC HEALTH SERVICE

Distributed by
THE BUREAU OF PUBLIC RELATIONS, AMERICAN DENTAL ASSOCIATION
212 E. Superior St., Chicago, Ill.



At twelve years of age, the twins have twenty-eight permanent teeth. This is a side view of a set of teeth like Jack's and Joan's. Notice that the upper and lower teeth fit together properly like this /\/\/\/\/\/\.

Several of their classmates have lost some of their teeth. They must grind their food with a chewing machine that fits together like this \/\/\/\/\/\.

This is a front view of a set of teeth like Jack's and Joan's. When the twins are about 18 or 20 years old, four other molar teeth, commonly called "wisdom teeth," will appear. Jack and Joan then will have their full set of thirty-two permanent teeth.

Notice the shapes of the teeth. The teeth are shaped differently because of the work they do. The front teeth, called incisors, have sharp edges to cut the food. The teeth at the corners of the mouth, called cuspids, have a sharp point or cusp to tear the food. The teeth just back of the cuspids, called bicuspids, have two points or cusps to crush the food. The back teeth called molars, have several points or cusps to grind the food. Every tooth has a crown and root. The front teeth have one root and the lower molar teeth have two roots. The upper molar teeth have three roots. The crowns of the teeth are covered with very hard material called enamel. The enamel protects the teeth from injury. The roots are covered with a thin material called cementum. The body of the tooth is made of a bonelike substance called dentin. In the center of each tooth is a hollow space called the pulp chamber, which contains the pulp. The pulp is made up largely of blood vessels and nerves. Figure 1 shows the different parts of a front or incisor tooth. Figure 2 shows the different parts of a lower molar tooth.

Uncle Dan told Jack and Joan a third secret that would help them to have good teeth. He said they should keep their teeth clean. He told them to use a small sized toothbrush. The bristles of the brush should be set far enough apart so that they can easily be cleaned. They should be of medium stiffness and of uneven length. Uncle Dan told them to use a tooth paste or powder that does not contain any harsh grit or strong medicine that will injure the enamel or hurt their gums. He told them to brush their teeth at least twice a day, after breakfast in the morning, and before going to bed at night.

This is the way Uncle Dan taught Jack and Joan to clean their teeth: Hold the jaws slightly apart. Brush the teeth of each jaw separately. Place the bristles of the brush on the gums above the upper teeth and brush down from the gums to the chewing surface. This downward movement brushes the food from between the teeth. It also massages the gums. Never brush across the teeth, because this will not remove the food from the crevices and moreover, may injure the gums. The lower teeth should be cleaned in the same way as the upper teeth. The brush should be placed on the gums below the teeth and drawn upward to the chewing surface. Brush the inside surfaces of the teeth as well as the outside surfaces. Do not fail to brush the chewing surfaces of the teeth as these uneven surfaces easily catch and hold particles of food.

If the twins' mother swept in circles, she would not get much dirt off the kitchen floor. By sweeping with long, even strokes, she removes the dirt easily. So it is with brushing the teeth. We should brush the upper teeth with a downward sweeping motion, and the lower teeth with an upward sweeping motion. This will remove any small food particles that might lie between the teeth. After thoroughly brushing the teeth, the mouth should be rinsed by forcing a mouthful of water several times between the teeth.

DENTAL HEALTH EDUCATIONAL MATERIAL FOR FOURTH AND FIFTH GRADE CHILDREN

Happy Days with Jack and Joan is an eight page booklet on the care of the teeth which has been especially designed for children between the ages of nine and eleven.

The names, structure and function of the teeth, as well as the fundamentals of dental health, are explained in an interesting, yet simple manner. The text is scientifically correct. The illustrations are modern and artistic. After each lesson is learned, the illustrations can be colored by the child. This booklet will enable educators to coordinate the teaching of dental health with that of art and reading.

Approved by educators, the American Dental Association and the United States Public Health Service.

Single booklet, 5c; sets of 35 booklets, 2c each.

50. EXHIBIT MATERIAL

A small rental charge is made for all exhibits plus express charges to and from Chicago.

A-1: Three 12-inch plaster models showing the value of the x-rays in discovering interproximal and other hidden decay.

A-2: Five 12-inch plaster teeth showing the progress of pyorrhea.

Both A-1 and A-2 shipped in one case. Rental per week, $3.

A-3: Two 12-inch plaster models showing the value of the x-rays in discovering the presence of root fragments.

A-4: Two 12-inch plaster models showing the value of the x-rays in discovering the presence of impacted teeth.

Both A-3 and A-4 shipped in one case. Rental per week, $3.

A-5: Four 12-inch plaster models showing the changes that often occur after the extraction of a tooth. Rental per week, $3.

For picture of the A series of models, see page 2387 of the December issue of The Journal of the American Dental Association.

B-1: Electrically motivated mechanical exhibit showing the progress of decay from its initial attack on enamel to the formation of an abscess; 3 feet high by 2½ feet wide, standing on a 3-foot base; all-over height, 6 feet. Rental per week, $5.

E-2. Four-foot stage upon which are mounted a number of small cutout figures representing bad teeth, a dentist, a toothbrush, tooth paste, vegetables, milk and fruit. Figures are mounted on a concealed endless belt motivated by an electric motor. Figures move from left to right across the stage, thus creating effect that they are chasing the decayed teeth away. Wt. 75 pounds. Rental per week.....$2.00

E-5. A large cardboard cutout view of a class room, 5 feet long by 3 feet high, showing a blackboard in the background upon which is printed different dental health lessons. Cutout figures of teacher and children are placed before this background. Shipped in fibre case. Wt. about 25 pounds. Rental per week.....$1.00

E-6. Ten large plaster models, each 18 inches in diameter. Nine models show progressive stages of dental caries and pyorrhea. One model shows child's mandible with deciduous and permanent teeth in place. Wt. 300 pounds. Rental per week.....$6.00

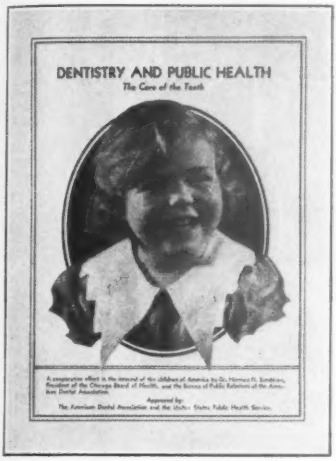
E-7. Sixteen life-size wax models, showing: dentition of 6 year-old child; effects of thumb sucking; normal occlusion and results of loss of first permanent molar; cross section of mouth; longitudinal section of molar; destructive action of calculus and decay. Shipped in 3 cases, total wt. 200 pounds. Rental per week.....$6.00

E-8. Two plaster plaques, each 18 by 36 inches in size, one showing the progress of decay from its initial attack on the enamel to the formation of an abscess; the other showing the progress of pyorrhea. Shipped in one case, total wt. 40 lbs. Rental per week.....$2.00

E-9. "Answer Your Own Dental Questions." An exhibit 6 feet wide by 8 feet high. By means of a revolving disk you can answer your own dental questions. Shipped in 2 fiber cases, total wt. 100 lbs. Rental per week.....$2.00

51. BOOKLET ON CARE OF THE TEETH

Attractive 32 Page Booklet

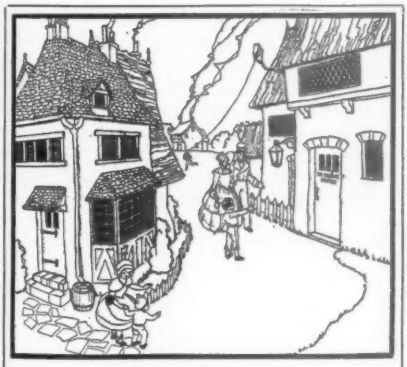


Written in lay language, illustrated with eighty photographs of actual cases and models. Each illustration tells its own story. Approved by the American Dental Association and the United States Public Health Service.

Prices—10c per single copy; 12 copies—$1.00; 50 copies—$4.00; 100 copies—$7.50; 500 copies—$25.00; 1000 copies—$45.00.

A BENEFICIAL PRODUCTION CIRCLE

52. DENTAL HEALTH POSTERS



Twice a year we come to town
Just to visit Dr. Brown
Dr. Brown our teeth inspects
And keeps them free from all defects.

Four 22″ x 28″ posters, in color (only one of which is shown), emphasizing four dental health rules for the care of the teeth: proper food, exercise, cleanliness, and regular dental attention.

Approved by the American Dental Association and the United States Public Health Service.

Single Posters, 35c; Set of 4, $1.00.

A BENEFICIAL PRODUCTION CIRCLE

53. DENTAL HEALTH CHARTS

Eight large charts, designed for high school and adult teaching.

Subjects covered: The teeth; the deciduous teeth; the permanent teeth; diet and teeth; dental care; mouth hygiene; preventing decay of the deciduous teeth; preventing decay of the permanent teeth.

Beautifully illustrated in five colors and bound with modern spiral binding into one complete dental health educational unit. 22x29 inches in size, each chart consists of one 14 inch illustration and five supplementary four inch illustrations accompanied by suitable descriptive text.

A BENEFICIAL PRODUCTION CIRCLE

THE BUREAU OF PUBLIC RELATIONS
American Dental Association
212 East Superior St., Chicago, Illinois.

☐ 1 Set—$1.00. ☐ Sets of 10—90c per set. ☐ Sets of 25—85c per set.
☐ Sets of 50—75c per set. ☐ Sets of 100—60c per set.

Name_____

Address_____

THE BENEFICIAL CIRCLE PLAN
and the
DENTAL EDUCATIONAL MATERIAL

Much of the dental health educational material listed in this prospectus has been developed under the "Beneficial Circle" Plan. Other material is being developed and will be released as rapidly as the facilities and support of the plan permit.

All of the dental educational material offered by the Bureau of Public Relations is ethical, authentic and interesting. Most of the newer material will be offered to the public under the approval of the United States Public Health Service as well as the American Dental Association.

ASSIST THE BENEFICIAL CIRCLE PLAN BY USING and recommending products advertised in THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION as increased advertising revenue will be used to develop further educational material.

LOOK FOR THE SIGN

ORDER BY NUMBER

The Bureau of Public Relations,
American Dental Association,
212 E. Superior St., Chicago, Illinois.

Enclosed is $_____ for Dental Health Educational Material corresponding to numbers below:

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Name _____

Address _____

Special Notice: To assist the Bureau in eliminating unnecessary bookkeeping and correspondence, *please remit the amount of your order at the time of ordering.* Remit by postoffice money order or stamps. *Please do not send personal checks for amounts of less than one dollar.*

DENTAL ECONOMICS

UTAH REFERENDUM ON DENTAL ANTI-ADVERTISING LAW*

DURING its last session, the Utah State Legislature passed a law prohibiting advertising by dentists. The new law was attacked by an organization known as the Peoples Dental League, headed, it is understood, by W. L. Withens, D.D.S.

During the past spring and summer, the league secured about 23,000 signatures to a petition urging a state referendum on the new dental law this November.

Vigilant members of the Utah State Dental Society soon discovered that many of the signatures on the petition were fraudulent. Also, opponents of the proposed vote filed a petition containing the names of 8,000 persons who wished to withdraw their names from the original petition.

Saturday, October 3, the Utah State Supreme Court ruled unanimously that the initiative petition was insufficient in three respects. The opinion written by Justice David W. Moffat holds:

1. The initiative petitions or petition copies failed to show that the purported signers were registered voters. The county clerks failed to indicate whether each name is that of a duly registered voter.

2. Those persons who had filed duly verified petitions to withdraw their names before the secretary of state had acted upon the petition . . . should be permitted to do so and their names should not be counted as petitioners.

3. No name signed to the petition that is not followed on the same line with the post office address of each signer, together with the street and number if the residence of the signer can be so designated . . . should be counted.

After this ruling, the court referred the petition back to the secretary of state, Milton H. Welling, to ascertain whether the remaining valid signatures were sufficient to qualify the petition, and to report his findings again to the court.

"After consulting with counsel for the sponsors of the proposed dental referendum petition," said secretary of state Milton H. Welling today at the Capitol, "we decided that it would be futile to attempt the clerical work required if the Supreme Court order of Saturday is conformed with."

Following is a copy of the initiative amendment as it would have appeared on the Nov. 3, 1936 ballot, had the state supreme court accepted the validity of the petition signatures.

INITIATIVE AMENDMENT

DENTAL ADVERTISING LAW PROPOSED TO BE ENACTED BY INITIATIVE

Being an act to amend Section 79-6-8, Revised Statutes of Utah, 1933, as amended by Chapter 78, Laws of Utah, 1935. (Making it legal for Dentists to Advertise.)

That Section 79-6-8, Revised Statutes of Utah, 1933, as amended by Chapter 78, Laws of Utah, 1935, be amended to read as follows:

79-6-8. The words "unprofessional conduct" as relating to dentists are hereby defined to include.

1. Obtaining any fee by fraud or misrepresentation.

*Information supplied by the Committee on Dental Legislation of the American Dental Association.

2. Employing directly or indirectly any student or unlicensed dentists, or one whose license has been revoked or suspended to perform operations of any kind or to treat lesions of the human teeth, gums or jaws, or take impressions of the teeth or jaws, or to correct or attempt to correct malpositions thereof, except as herein provided.

3. Employing what are known as cappers, steerers or touters to obtain business.

4. Communicating, without the consent of the patient, information acquired in treating a patient necessary to enable him to act for such a patient.

5. Advertising his dental business or treatment or devices by untruthful, improbable or impossible statements.

6. Making any misrepresentations or false promises directly or indirectly to influence, persuade or induce dental patronage.

7. Sharing professional fees with an unlicensed person or paying any person for sending or referring patients.

8. Practicing while his license is suspended.

9. Using intoxicants or drugs to such an extent as to render him unfit to practice dentistry.

10. Maltreating his patients by reason of gross ignorance, wilfulness or neglect.

11. Gross immorality, dishonorable or improper conduct, or conviction of a felony.

12. Violating or aiding others in violating any of the provisions of the dental practice act.

13. Refusing the Department of Registration or the State Board of Health, their officers or employes, access to his office, instruments, laboratory, equipment, or appliances or supplies for the purpose of inspecting the same.

14. Keeping his office, instruments, laboratory equipment, appliances or supplies in an insanitary condition.

15. Nothing herein contained shall be construed so as to prevent a duly licensed dentist in the State of Utah from advertising his profession, except the quotation of definite fixed prices, by the use of newspapers, periodicals, signs, cards, radio and other lawful means of advertising, provided, that all of such advertising shall be in the name of the licensed dentist who may specifically refer in such advertising to his training, method and-or-system.

Section 2. This act shall take effect five days after the date of the official proclamation by the Governor.

MINNESOTA DENTAL HEALTH EDUCATIONAL PROGRAM

Using Social Security Funds, the Minnesota State Department of Public Health has created a new dental health section. Vern D. Irwin, of Duluth, has been appointed director.

The law provides that the appropriation is to be used entirely for educational purposes. No treatment or material aid will be possible in any part of the state program. Lectures, class demonstrations, the distribution of literature and other methods of education will be resorted to, in getting health information to the public. This will be accomplished through association channels and the regular channels of the division of child hygiene and also, systematically, through locally organized units throughout the United States.

The Minnesota State Dental Society has developed a comprehensive plan by which it will be able to cooperate with the state board of health. This plan provides for an advisory committee composed of representatives of the statewide organizations, such as the public health nurses, medical profession, dental profession and lay welfare groups. Another

committee, known as the Local Advisory Committee is to be organized within each of the counties into which the program is to be extended. The minimum membership of the committee will consist of the county superintendent of schools, the county health officer, a county commissioner and two residents of the county appointed by the county commissioners.

The Minnesota State Dental Association should naturally assume the position of the guiding agency. It will have direct contact with the activities of the state dental health division, principally through two main committees, a lay-dental committee and the oral hygiene committee of the state association.

The promotion of dental health education in the Minnesota plan is designed to proceed through such channels as: (1) schools, public and parochial; (2) public health nurses; (3) teachers' colleges; (4) schools for public health nurses and hygienists; (5) civic organizations, and (6) press, radio and literature.

Perhaps the most valuable channel at present is the school system. The state department of education has made it possible to introduce dental health education in the elementary schools. With this end in view, the state oral hygiene committee compiled a handbook for teachers on dental health education in elementary schools. This handbook was revised and approved by the department of hygiene of the state department of education, and is now in circulation.

MINNEAPOLIS SCHOOL DENTAL HEALTH PROGRAM

The Minneapolis school dental health program is operated by the board of education. The staff consists of one part-time director, F. Denton White, who serves with remuneration, and nine full-time dental hygienists, who are classified as teachers.

The schools are divided into districts. One hygienist is assigned to approximately twelve schools, which are comprised of about 6,300 elementary pupils. The hygienist examines the teeth of all children in her school each fall. This requires about two months of her time. Notification slips regarding the child's dental condition are sent home to the parents. During the remainder of the school year, the hygienist divides her time among the schools, giving class lessons (see graded program) in her schools so that the children in each school are visited seven times a year.

At the close of the school year, each child is given a letter. Children who have good teeth and who are having the teeth cared for receive one type of letter. Children who are not having their teeth cared for receive a different type of letter.

The program is entirely educational in character. No operative work is attempted. The teaching of dental health is correlated with the teaching of other subjects, such as writing, music, art and arithmetic. Letter books, scrap books, puppet shows, playlets, etc., are also used in order to create in the mind of the child a desire for a healthy mouth.

Approximately 50,000 children receive dental examinations each year.

All children needing dental service are referred to the family dentist for care.

In 1929, 12,663 children were found to need extractions.

In 1935, 6,226 were found to need extractions.

In 1935, the children in eighty-five

rooms had teeth 100 per cent cared for.

In 1936, the children in 104 rooms had teeth 100 per cent cared for.

In 1935, 87.7 per cent of the children who brought back dental examination slips went to their own dentist.

In 1936, 91 per cent went to their own dentist.

In 1934, retardation in Minneapolis schools was 10 per cent.

In 1935, retardation in Minneapolis schools was 3.6 per cent.

Children's Dental Clinic

The Children's Dental Clinic of the Philadelphia Mouth Hygiene Association was inaugurated Jan. 1, 1934. The staff consists of six operative dentists, one supervisor, one exodontist, one prosthodontist, six dental hygienists and a registered nurse anesthetist. This staff has been carefully selected not only for professional skill but also for ability in handling children. After each child meets the requirements of registration, he receives a complete prophylactic treatment by a dental hygienist. Thereafter, he receives a thorough examination and diagnosis by a dentist. The first step in every child's program is the elimination of all types of infection, such as inflammation of the gums, abscesses or extensive decay of the teeth. The child is then permitted to make appointments for reparative work in the operative clinic. Active decay is checked as quickly as possible and all operations are based on a schedule of half-hour treatments. The use of the roentgen rays has proved extremely valuable in the diagnostic service. Nitrous oxide anesthesia is used in many of the extraction cases. The children are given instruction regarding mouth hygiene and diet. When all dental work is finished, the child is requested to return in from four to six months for an examination and such further care as may be indicated.

The clinic accepts only children who cannot afford care in regular channels. It does not treat adults. Children are charged 50 cents per treatment, although many children are referred by various health and hospital agencies in Philadelphia. The income is derived from contributions and from fees for dental service. The address of the Philadelphia Mouth Hygiene Association is 124 North Fulton Street, Philadelphia, Pa.

New German Dental Regulations

According to a public announcement by the minister of the interior of the results of group examinations of persons of various ages, and the observations of the sick insurance societies, the health of the German people is being seriously imperiled by a formidable spread of dental diseases. Under these circumstances the care of the people's teeth by both dental physicians (zahnärzte) and so-called dentists (dentisten) has taken on a greater significance. As an initial step to eradicate professional deficiencies, the overcrowded state of the two groups, namely, the zahnärzte and the dentisten, is being combated. The dentisten are those persons who, despite their lack of a regular university training, are engaged in the practice of dentistry. Members of this group are graduates of a "dentist's school" but their education is far from complete and they are not dental physicians (zahnärzte). For these reasons the admission of new students to the regular dental schools has been for the first time temporarily stopped. Since the educational requirements of the dentisten have not yet been legally regulated, only those persons shall henceforward be permitted to take the public examination for dentisten who are at present preparing themselves for admission to that professional group. So for the time being the admission to training schools for dentisten has also been stopped. (The calling of dental mechanic [zahntechniker] is not affected by these measures; these technicians are only assistants to the dental physicians by whom they are employed to do the mechanical work.)

Attention has been called previously to the fact that the health of the German people may be seriously impaired by the spread

of dental disorders. The prevalence of such disorders has been evidenced by the results of physical examinations in the defense forces. According to these observations 14.86 of each hundred men examined were designated as "fit on condition" because of "bad teeth." On the basis of these examinations, together with the finding that of 558 apprentices in a South German industrial establishment only 7.5 per cent did not stand in need of dental care, Dr. Kientopf, director of the Berlin Municipal School Dental Clinic, a man who formerly occupied an influential position in the public health councils of National Socialism, has demanded that a program of compulsory treatment of dental, oral and maxillary disorders be instituted. The customary examinations by the school physician are distinctly inadequate, since they take place at too widely separated intervals and because the school doctor is in no position to carry out a comprehensive program of dental care among school children.

Attention is finally called to the great importance attributed to suitable bread nutriment. The newly founded cooperative association and the dental institute of the University of Berlin set forth as the objective that by means of an adequate nutrition accessible to the entire population the internal causes of dental caries be reduced to a minimum.

Professor Flössner called to mind in this connection that in Germany 40 per cent of the necessary nutrition was supplied by bread and flour. The controversial question "Should wheat bread or rye bread constitute the bread nutriment?" no longer exists, since no important physiologic-chemical differences between the two types can be distinguished. Science is today concerned with another problem, that of the degree of milling to which grain should be submitted, for it is assumed that a causal relationship between a certain group of diseases (including caries) and insufficiently milled flour can be established.

Dr. Kraft pointed out that white grain bread because of its content of protein, vitamins, cellulose and mineral substances represents a food of the highest nutritive value. The dietetic physiologist Professor Scheunert of Leipzig spoke of the importance of the vitamin content of bread. That the population may be amply supplied with vitamin B_1, the largest possible supply of whole grain bread, or at least of a black bread in which 82 per cent of the grain has been utilized, is recommended. If the regimen is sufficiently varied and comprises vegetables, fruit, milk, eggs and so on, deficiency in vitamin B_1 could scarcely be present. According to Scheunert's most recent research, only bread that represents the greatest possible utilization of the grain, in quantities of from 300 to 400 gm. daily, can supply the day to day need for vitamin B_1. If gray bread or white bread is eaten, a considerable part of the vitamin B_1 need must be supplied by other types of food.

Professor Euler, director of the dental institute of the University of Breslau, furnished most illuminating communications on the interrelation of the nutrition of the mother and the teeth of the infant. Children were 95 per cent free from caries if, during pregnancy, their mothers had consumed generous quantities of fresh green vegetables, salads, fruits, tomatoes, carrots and raw sauerkraut.—*J.A.M.A.*, Oct. 31, 1936.

The Regulation of Dental Practice in Yugoslavia

A new law definitely settles the troublesome question of dental practice by declaring that dentistry can be carried on by duly qualified doctors or dental technicians who have specialized in stomatology. Those dental technicians who gained their right to practice before 1932 may continue their work without disturbance. Those whose license was not recognized by the revision in 1935, if over 42 years of age, will have to pass qualifying examinations in December 1936, while those under 42 will have to attend regular courses, lasting six months, in dental technic and pass the final examination. Only those technicians are justified in applying for admission to the courses who before 1932 had already five years of practice (two years as apprentices and three years as assistants in labora-

tories). Those who have passed a matriculation examination in a secondary school and attended some foreign high school for dentistry and obtained a diploma after four years of study may carry on dental practice in Yugoslavia without further notice. Dental technicians and also dental surgeons are not allowed more than one consulting room.

Diathermy machines, quartz-light lamps, therapeutic short-wave sets and x-ray apparatus may be owned and used by qualified physicians only. Likewise electrolysis and electrocauterization should be applied by physicians, and this exclusively medical work must not be done by barbers, masseurs, manicurists, chiropodists or cosmetic institutes.—*J.A.M.A.*, Oct. 31, 1936.

Medical Practice Acts: Corporate Practice of Medicine Illegal in Illinois

The United Medical Service, Inc., a corporation organized for profit, operated a clinic in Chicago, rendering an advertised fixed-fee, low-cost medical service through licensed physicians employed and paid by the corporation. The state, by its attorney general, petitioned for leave to file an information in the nature of a quo warranto to require the corporation to show by what warrant it engaged in the practice of medicine. The trial court held that the corporation could not legally practice medicine in Illinois and rendered a judgment against it. From this judgment the corporation appealed to the Supreme Court of Illinois.

If the medical practice act be construed to prohibit corporations from practicing medicine by employing licensed physicians to that end, the United Medical Service contended, the act constitutes an unreasonable exercise of the police power by the state. The police power of the state, said the Supreme Court, includes the power to enact comprehensive, detailed and rigid regulations for the practice of medicine, surgery and dentistry. There is no right to practice medicine which is not subordinate to the police power. To sustain its contention, the United Medical Service relied on *Liggett* v. *Baldridge*, 278 U. S. 105, 49 S. Ct. 57, 73 L. Ed. 204, wherein the United States Supreme Court held invalid a Pennsylvania statute providing that every pharmacy or drug store should be owned only by a licensed pharmacist, and that no corporation, association or copartnership should own a pharmacy unless all the members or partners were licensed pharmacists. The United States Supreme Court held that mere stock ownership in a corporation owning and operating a drug store could have no real or substantial relation to the public health and that the law was an unreasonable and unnecessary restriction on private business. It does not follow, however, said the Supreme Court of Illinois, that because a person may have a constitutional property right to operate a drug store he has a like absolute right to engage in the practice of a profession such as medicine, dentistry or law. Neither a natural person nor an intangible entity can complain if unable to fulfil the requirements reasonably prerequisite to obtaining a license to engage in a particular profession. The holding in the Liggett case, continued the court, does not conflict with the well established rule that the state may deny to corporations the right to practice professions and insist on the personal obligations of individual practitioners.

To practice a profession requires something more than the financial ability to hire competent persons to do the actual work. It can be done only by a duly qualified human being, and to qualify something more than mere knowledge or skill is essential. . . . No corporation can qualify.

The judgment of the superior court against the United Medical Service, Inc., was therefore affirmed.—*People, by Kerner, Atty. Gen. v. United Medical Service, Inc. (Ill.), 200 N. E. 157.*—*J.A.M.A.*, Oct. 24, 1936.

CURRENT LITERATURE

Repair of Cleft Palates Primarily Unsuccessfully Operated on (E. C. Padgett, Surg., Gynec. Obst., 65:483 [Oct.] 1936): In a series of 300 patients operated on for cleft palate, 143 had been previously operated on one or more times, the average being two and three tenths times. When there is little or no loss of tissue, the Dieffenbach-von Langenbeck operation was usually applicable. In short palates, the union of the posterior pillars was added to the standard operation and in fifteen of nineteen cases the pillars remained united. In some instances, a flap from the lip was used to close defects between and back of the cleft alveolar ridge. In cases showing a large midline loss of tissue in the hard palate, a modified Dieffenbach-von Langenbeck operation was utilized with labial or buccal flaps. Occasionally, the Lane operation offered advantages. If part or most of the mucoperiosteal flap of the hard palate was lost, a broad and long cheek flap or Lane type flap was used. In those cases in which there were holes in the anterior or lateral palate immediately adjacent to the alveolar process, response to the plastic flap procedure was poor, and it was sometimes found necessary to plug the defect with a prosthesis. Large defects at the hard palate-soft palate juncture were usually repaired by long lateral palate flaps, with fracture of the hamular processes. In addition, in children over 4 or 5 years of age, a unilateral cheek flap was utilized. When a considerable cleft is present in the soft palate, the Dieffenbach-von Langenbeck principle plus suturing of the posterior pillars could be used only if sufficient soft tissue was present. In sixty-eight cases, a posterior pharyngeal flap was used with fair to very good functional results in thirty-seven instances. In nine cases, extraoral flaps were used with success in all but one patient, later found to be epileptic. Individual study of the patient and selection of the operation apparently promising best functional and anatomic results is recommended.

HAMILTON ROBINSON.

Duplication of Congenital Malformations in Brothers and Sisters and Among Other Relatives (Douglas P. Murphy, Surg. Gynec. Obst., 63:443 [Oct.] 1936): Normally developed siblings frequently resemble each other in appearance, and in many families brothers and sisters present identical congenital deformities. The author describes his method for collecting data. The findings are clearly shown by means of tables. A consecutive series of forty families having two or more congenitally malformed children were studied with respect to the duplication of defects in siblings. The defects observed in the first malformed child reappeared in a subsequent malformed sibling in about 50 per cent of all cases; the 50 per cent remaining including all other possible defects. In another group, of thirty-nine consecutive families, in which a malformed child had a malformed relative, the malformation in the child and in the relative were identical in about 41 per cent of cases. In nineteen nonconsecutive families with two or more malformed children, the defect of the first child was repeated in a subsequent child in more than half of the families. From this analysis and previous studies, it is concluded (1) that many, if not most, of the congenital malformations met with in this study resulted from defects in the the germ plasm, which were present before fertilization; and (2) that when a congenital malformation is suspected in an unborn fetus, the obstetrician will do well to investigate the family history and the parents' previous reproductive history for the existence of other defective members. This information not only may confirm the suspicion that

the fetus is malformed, but also may aid in recognizing the type of defect that is present.

J. FRANK HALL.

Xerostomia from Roentgen-Ray Treatment for Hypertrichosis (S. S. Greenbaum, and H. Turner, J.A.M.A., 107:1297 [Oct. 17] 1936): The authors point out that the use of roentgen-rays to prevent the growth of hair is frequently followed by serious results. With some x-ray systems, cutaneous atrophy or telangiectasia results; with others, the oral mucous membranes and salivary glands are affected. The latter results are well known to radiologists who use roentgen-ray therapy for malignant growths in the oral cavity. A case of xerostomia is reported in a young woman who had received treatment at the hands of a "cosmetologist." The authors find that many of these patients report first to their dentists.

B. G. BIBBY.

Pulmonary Gangrene in Children (J. W. Epstein, Am. J. Dis. Child., 52:331 [Aug.] 1936): Pulmonary gangrene is a distinct clinical entity characteristically produced by the presence of spirochetes, fusiform organisms and vibriones. A penetrating foul odor from a coughing patient suggests the diagnosis, which is confirmed by bacteriologic examination of the sputum. Associated oral lesions (caries and gingivitis) are significant, especially in children, since the oral flora of young children does not, as a rule, include the oral spirochetes. Numerous tonsillectomies and adenoidectomies favor the aspiration of infected material from the mouth in children. The author reports seven cases of pulmonary gangrene in children, five of which were preceded by tonsil or adenoid operations. The author states that "as pulmonary gangrene results from the aspiration of anaerobes from the oral cavity, the importance of proper oral hygiene is self-evident."

HAMILTON ROBINSON.

Relationship of Vitamin C to Hemorrhagic Diastheses (D. J. Stephens and E. E. Hawley, J. Lab. & Clin. Med., 22:173 [Nov.] 1936): Since demonstration of the striking response of hemorrhagic manifestations of scurvy to vitamin C therapy, favorable reports have been recorded for cevitamic acid therapy in other types of bleeding and clotting disturbances. The authors correlated clinical observations of hemorrhagic phenomena with blood changes, capillary resistance and urinary excretion of vitamin C before and during administration of large amounts of orange juice. Four patients with hemophilia and two with atypical chronic thrombocytopenic purpura were studied. Results suggest that there is no characteristic abnormality of vitamin C metabolism and no constant therapeutic effect of antiscorbutics in hemophilia or thrombocytopenic purpura. Theoretically, vitamin C therapy can be expected to be of benefit in cases of capillary hemorrhage only in instances of vitamin C deficiency.

HAMILTON ROBINSON.

Chronic Endemic Dental Fluorosis (Mottled Enamel) (H. T. Dean, J.A.M.A. 107:1269 [Oct. 17] 1936): This paper presents a thorough review on the occurrence, etiology, histopathology and prevention of mottling of enamel. The localities where it is endemic in United States and other countries are listed. The relationship to the fluorine content of the water supply during the formative periods of the enamel is supported by chemical and clinical evidence. This shows that a 10 per cent occurrence of mottled enamel is likely where the water supply contains 1 part per million of fluorine, and reaches as high as a 100 per cent occurrence where there are 6 parts per million of fluorine.

B. G. BIBBY.

Three Hundred Mixed Tumors of Salivary Glands of Which Sixty-Nine Recurred (Joseph McFarland, Surg., Gynec. Obst., 63:457 [Oct.] 1936): This is the fourth in an unnumbered series of studies on salivary gland tumors by the author, who briefly reviews the contents of the preceding articles. In his conclusions, he states: 1. Of 297 mixed tumors of the parotid, submaxillary and sublingual glands, 23.23 per cent recurred and thirteen proved fatal. 2. En-

deavors to correlate the histopathologic structure of the tumors with their clinical behavior totally failed, and it is not believed that the microscope is an aid to prognosis. 3. Recurrence takes place at any time from "immediately" up to forty-seven years after operative removal; hence, it is impossible to prove that any case has been cured or that any kind of treatment is certainly useful. 4. Such data as have been collected and analyzed do not indicate that either x-rays or radium are of any greater value than the knife. 5. Convincing figures are given to show the importance of postponing operation until the tumor is "ripe"; that is, about the size of a lemon. The smaller the removed tumor, the greater the probability of recurrence.

J. Frank Hall.

Factors in Quantitative Measurement of Roentgen-Ray Absorption of Tooth Slabs. V. Theory of Step Tablet (H. C. Hodge and S. L. Warren, Am. J. Roentgenol., 36: 391, 1936): By combining the equation for roentgen-ray absorption in filters with the equation for photographic exposure and density, a specialized equation is obtained which is used (1) to calculate the "effective" mass coefficients of absorption of enamel and dentin, (2) to predict relations between initial velocity and kilovoltage, (3) to calculate the half-layer of a filter and (4) to calculate the "effective" gamma of a filter emulsion.

H. C. Hodge.

Dental Changes in Rats Consuming Diet Poor in Inorganic Salts (S. S. Arnim, M. F. Clarke, B. G. Anderson and A. H. Smith, Yale J. Biol. & Med., 9:117 [Oct.] 1936): The normal molar teeth and their supporting structures in the rat are described, together with changes in these structures associated with the ingestion of an experimental ration extremely poor in inorganic salts. Nineteen animals received the deficient diet for twelve weeks and were then killed. Forty-four received the same diet for the same period of time and then an adequate inorganic salt diet for four, eight or twelve weeks. Thirty were fed adequate diets as controls. The low-salt diet rats presented a characteristic general body appearance of malnutrition with extreme fragility of bones. The oral findings included irregular dentin formation in the part of the cusp formerly occupied by the pulp; wearing of cusps which, in some cases, resulted in breaks filled with amorphous material, necrotic dentin and food débris; polymorphonuclear and mononuclear cell collection in the pulp; distension of pulpal blood vessels; in some instances, partial necrosis of the pulp; periapical abscess; resorption of cementum and dentin, and retrogressive changes in alveolar bone. Dentinal and bony changes were observed in all nineteen of the animals on deficiency diets. In the realimented rats newly formed plugs of tubular secondary dentin separated the pulp from the irregular dentin in those cases where the pulp was not actually exposed. The alveolar bone showed progressive repair. The authors' results suggest, histologically, that dentin is a far more stable structure than bone; rations poor in inorganic salts lead to irregular dentin and marked rarefaction of bone, but not to resorption or rarefaction of formed dentin; and that repair of bone and additional deposition of dentin may be brought about by realimenting the low-salt diet with an adequate diet.

Hamilton Robinson.

Foreign Literature

Cancrum Oris (Fu-tang Chu and Chuan Fan, Chinese M. J., April, 1936, page 303; abstr. Brit. M. J., Sept. 19, 1936, page 43): The authors describe their observations on 100 cases of cancrum oris admitted to the Union Medical College Hospital at Peiping from February, 1901, to May, 1935. Kala-azar was found to be the predisposing disease in 79 per cent, measles in 4 per cent and bacillary dysentery in 3 per cent. The incidence of cancrum oris in patients with kala-azar was 15 per cent. The most dangerous complications were bronchopneumonia and dysentery, which were almost always fatal. The treatment consisted in a well-balanced diet including an abundance of vitamins A and C, minced liver and iron in the form of ferric

ammonium citrate when the anemia was severe, intravenous injections of neo-arsphenamine, blood transfusion and local applications of hydrogen peroxide and sodium perborate.

J. FRANK HALL.

***Eunarcon Anesthesia** (K. Mensing, Deutsch. Med. Wchnschr., June 12, 1936, page 970; abstr. Brit. M. J., Sept. 12, 1936, page 41):* The author gives an account of his experience with 100 cases of eunarcon anesthesia in the past year and a half. Eunarcon is a 10 per cent solution of the water-soluble sodium salt of C-C-isopropyl -B-bromallyl-N- methylmalonylureides. The injections induced superficial respiration, which not infrequently culminated in complete cessation of respiration, while the pulse remained strong. If the pulse is satisfactory, the superficial character of the respiration may be safely ignored. The author cites some of his more interesting cases. He emphasizes the necessity of injecting the solution slowly in patients over 45 years of age. He believes that eunarcon is contra-indicated for patients suffering from peritonitis, severe diabetes or disease of the parenchyma of the liver. The patient has no ill effects from repeated injections of the anesthetic at frequent intervals. The author injected one of his patients with eunarcon four times in the course of two weeks and observed no ill effects.

J. FRANK HALL.

Ueber den anorganischen Aufban der Zahne (Inorganic Structure of Teeth) (W. F. Bale, M. L. LeFevre and H. C. Hodge, Die Naturwissenschaften, 24:636, 1936): Dentin gives the roentgen-ray diffraction pattern of hydroxyl-apatite even after ignition for one hour at 900 C. After five hours ignition, certain samples of dentin gave a changed pattern, that called -$Cu_3P_2O_8$ by Tromel and Moller. This is the first physical evidence of differences in molecular makeup of the inorganic tooth substance from tooth to tooth. The difference is tentatively ascribed to different amounts of phosphate ions adsorbed on the exceedingly minute crystals of the hydroxyl-apatite. Enamel gave no such change; the explanation being that since enamel crystals are larger, there is less surface for absorption of phosphate ions.

H. C. HODGE.

Nourishment in Cases of Radiologic Reaction of Mucous Membranes of Mouth and Throat (Kule Palmatierna, Acta. Radiol., 16:301, 1935): The author suggests a diet that can be easily eaten by the patient suffering from reaction of the mouth and throat to radiotherapy. A mixture is fed consisting of butter melted slowly in a sauce pan, to which is added gradually 20 gm. of wheat flour during the melting process. To this mixture, 30 gm. of maltose dissolved in 1,000 gm. of milk is added, and the whole is brought to a boil, then set aside to cool. After cooling, one beaten egg yolk is added. One and one half quarts of this mixture will supply the necessary calories; i. e., 1,650 calories, with 48 gm. of albumin, 120 gm. of carbohydrate and 105 gm. of fat.

J. FRANK HALL.

MISCELLANY

BOOK REVIEWS

A Textbook of Surgery. By John Homans, M.D., Clinical Professor of Surgery. Compiled from lectures and other writings of these members of the Surgical Department of the Harvard Medical School: Arthur W. Allen, David Cheever, Edward D. Churchill, Harvey Cushing, William P. Graves, Robert B. Greenough, John Homans, Gilbert Horrax, Daniel Fiske Jones, William E. Ladd, George A. Leland, Howard A. Lothrop, Richard H. Miller, Edward H. Nichols, Robert B. Osgood, Charles Allen Porter, Tracy J. Putnam, Lyman G. Richards, Edward P. Richardson, Channing C. Simmons, J. Herbert Waite, Wyman Whittemore, Philip D. Wilson. Fourth Edition. With a special bibliographic index and with illustrations by Willard C. Shepard. 1267 pages; price, $8. Published by Charles C. Thomas, Springfield, Ill.; Baltimore, Md., 1936.

That a book of this size has come to the fourth edition in so short a time would indicate a most satisfactory presentation of the subject. It would seem desirable for the dentist to obtain at least a fragmentary knowledge of the surgery of the body, and this book furnishes a convenient means of supplying this without going minutely into the detail of every subject. If a dentist would follow the outline presented in this volume, he would have at least a very satisfactory idea of the body as a whole so that he could display a reasonable degree of intelligence and be able to talk acceptably on almost any medical topic.

The chapter of the greatest interest to the dentist is that on the mouth, tongue and jaws, and while the well-informed dentist will find little in this chapter that he does not already know, it will do him no harm to review the subject in this volume.

The book as a whole is a mine of useful information, and we commend it to the consideration of the dental reader.

Dental Pharmacology and Therapeutics. By J. R. Blayney, B.S., D.D.S., M.S., Professor of Dental Pathology and Therapeutics, University of Illinois, College of Dentistry. Illustrated. 340 pages. Price, $4. Second Edition. Published by the C. V. Mosby Company, St. Louis, 1936.

To the dentist who is familiar with the painstaking work of Dr. Blayney, no word of commendation need be said on this new edition of his book. It is a pleasure to read such a volume; and it is not only a pleasure, but the book is also of great value in the study of this fascinating and informing subject. The consideration of pharmacology and therapeutics is becoming increasingly important. We need to know more about the drugs we use and their effect on the physical economy. Dr. Blayney's book brings to us a logical and systematic presentation of the subject in such form that not only the practitioner but also the beginning student may grasp the ideas taught without difficulty. The book has one supreme virtue: it is not padded. For which the author should receive the gratitude of the profession. The book is a noteworthy addition to the literature of the profession.

Essentials of Oral Surgery. By Vilray Papin Blair, A.M., M.D., F.A.C.S., Professor of Clinical Surgery in the School of Medicine and Professor of Oral Surgery in the School of Dentistry, Washington University, St. Louis, and Robert Henry Ivy, M.D., D.D.S., F.A.C.S., Professor of Maxillo-Facial Surgery in the Graduate School of Medicine and Professor of Clinical Maxillo-Facial Surgery in the School of Dentistry, University of Pennsylvania, Philadelphia. With the collaboration of James Barrett Brown, M.D., F.A.C.S., Associate Professor of Clinical Surgery in the School of Medicine, Washington University, St. Louis. Second Edition. 606 pages. Price, $6.50. Published by the C. V. Mosby Company, St. Louis, 1936.

The authors of this book have written so extensively and acceptably in the periodical literature of the profession that their work has become familiar to the profession generally. Now the second edition of their book has come out, giving them an opportunity to bring every procedure and every theory up to date. They have attracted to their aid the ideas of the leaders of the profession in every special line of endeavor bearing on the subject, with the result that the present volume embodies a very comprehensive presentation of the topic as a whole, at the same time outlining in the greatest detail the operative procedures in certain of the more complicated operations.

A faithful study of this book will give the student a satisfactory grasp of the principles and practice of oral surgery, and the whole is presented in a most attractive way through the medium of good type and clear cuts. The illustrative material is particularly fine and the entire volume is a credit alike to the authors and to the publishers.

Manual of Dental Roentgenology. By S. S. Wald, D.D.S., head of the Department of Roentgenology of the Murry and Leonie Guggenheim Dental Clinic and School for Dental Hygienists; Assistant Professor of Roentgenology, College of Dentistry, New York University; Lecturer in Dental Radiology, College of Medicine, New York University. Illutsrated by 62 cuts. 72 pages. Price, $2.25, plus postage. Published by the Murry and Leonie Guggenheim Dental Clinic and School for Dental Hygienists, New York City.

A preface by John Oppie McCall, D.D.S., director, accompanies the volume, and in it he very appropriately emphasizes the dual requisites for acceptable work in this field, i.e., satisfactory technic and accurate interpretation.

This manual, particularly to the beginner, is invaluable, and every student will find it to his advantage to possess one. The blank at the back of each page will enable the student to make his individual notations, and this sort of record making must be conceded to be of the greatest possible value. We commend the manual most highly.

A Dictionary of Dental Science and Art. Comprising the words and phrases proper to dental literature, with their pronunciation and derivation. By William B. Dunning, D.D.S., F.A.C.D., Professor of Dentistry, School of Dental and Oral Surgery, Columbia University; Member, Committee on Nomenclature, American Dental Association; Formerly Editor *The Journal of the Allied Dental Societies;* and S. Ellsworth Davenport, Jr., D.M.D., F.A.C.D., Formerly Associate Editor *The Journal of the Allied Dental Societies.* With 79 illustrations, 12 of which are in color. 635 pages. Price, $6.50. Published by P. Blakiston's Son & Co., Inc., 1012 Walnut St., Philadelphia, 1936.

This is a book to which the profession has been looking forward with the greatest anticipation. The mere names of the authors and publishers were sufficient guarantee of its excellence, and now that the volume is out, the result is most gratifying.

Many unique features never before introduced in a dictionary will appeal to the reader and particularly in the character and number of illustrations. It is seldom that such a profusion of illustrative material is presented in a dictionary. To peruse this volume will not only instruct the reader, but will entertain him as well. Every dental library should contain a copy of this book.

A Text-Book of Dental Pharmacology Materia Dentica and Pharmaco-Therapeutics. By William H. O. McGehee, M. D., D.D.S., F.A.C.D., Formerly Professor of Dental Pathology, Materia Medica and Therapeutics in Western Reserve University; Formerly Professor of Dental Pharmacology and Therapeutics in the Medical College of Virginia; Author of "A Textbook of Operative Dentistry," "A Textbook of Operative Technics," and "A Textbook of Operative and Dental Anatomy Technics." 489 pages. Price, $4.25. Published by P. Blakiston's Son & Co., Inc., 1012 Walnut St., Philadelphia, 1936.

This is far from being a dry-as-dust volume. Following the cue of the Curriculum Survey Committee of the American Association of Dental Schools, the author of

this book has developed his subject according to the most recent and up to date method of approach. He has drawn liberally from such publications as Accepted Dental Remedies of the Council on Dental Therapeutics, the National Formulary, and New and Nonofficial Remedies. The selection of proper drugs as well as their use is of the utmost importance in the practice of dentistry, and we commend this volume to the consideration of student as well as practitioner.

Physiological Chemistry. By J. F. McClendon, Ph. D., Professor of Physiological Chemistry, Medical School, University of Minnesota, Minneapolis; and the late C. J. V. Pettibone. Sixth edition, revised and enlarged. 454 pages. 34 illustrations. Price, $3.50. Published by The C. V. Mosby Company, St. Louis, 1936.

When a book has run into six editions, there can be no question of its merit. Physiological chemistry may be said to hold the key to many manifestations in tissue building and tissue tearing down. The book touches on the various foods as they affect the diet, and a better knowledge of this subject will give us a more intelligent grasp of the life forces. Every student should study this book, as should every practitioner. It will well repay the effort.

NEWS

Death of Dr. Webster: Albert Edward Webster, professor emeritus of dentistry at the University of Toronto, editor of the *Dominion Dental Journal* and author of various books on dental practice, died recently, at the age of 69. He received his dental training at the Chicago College of Dental Surgery and was also a graduate of Rush Medical College. Dr. Webster was a past president of the Canadian Dental Association, the American Institute of Dental Teachers and the International Association for Dental Research. He won the William Jarvie Fellowship medal for research and scholastic attainment in 1932.

Deaths

Abbott, Leonard W., Philadelphia, Pa.; Pennsylvania College of Dental Surgery, 1906; died March, 1936.

Burkhart, A. P., Auburn, N. Y.; died November 6. Dr. Burkhart had been the secretary of the New York State Dental Society for twenty-seven years.

Casselman, Don, Tracy, Minn.; University of Minnesota, College of Dentistry, 1905; died August 13.

Chase, David T., Portland, Ore.; North Pacific College of Oregon, School of Dentistry, 1925; died October 23; aged 46.

Diedrich, J. W., Bemidji, Minn.; University of Minnesota, College of Dentistry, 1915; died September 19.

Dilworth, J. Warren, Philadelphia, Pa.; Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania, 1899; died October 22.

Hanks, John T., New York City; New York College of Dentistry, 1891; died suddenly, November 18. (A more extended notice will appear in the January issue.)

Hanson, Charles W., Ashland, Ore.; North Pacific College of Oregon, School of Dentistry, 1906; died September 20; aged 58.

Hendry, Alexander J., Myrtle Creek, Ore.; died September 20; aged 77.

Hochherz, Charles J., Milwaukee, Wis.; Wisconsin College of Dentistry, Department of Carroll College, 1904; died August 13; aged 67.

Holcomb, Harry V.; University of Southern California, College of Dentistry, 1917; died October 20.

Lyons, Leo, Queens Village, N. Y.; New York College of Dentistry, 1919; died August 10.

Nowak, Stanley, Hammond, Ind.; Indiana University School of Dentistry, 1924; died October 4; aged 38.

Patterson, Harry Bird, Philadelphia, Pa.; Pennsylvania College of Dental Surgery, 1902; died September 28.

Stiles, John G., Canton, Miss.; University of Tennessee, College of Dentistry, 1934; died September 13; aged 34.

Tamiesie, Joseph C., Portland, Ore.; North Pacific College of Oregon, School of Dentistry, 1906; died September 20; aged 55.

Wallis, William D., Milwaukee, Wis.; died October 5.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association, Atlantic City, N. J., July 12-16.

Academy of Anesthesiology, New York City, November 18.

American Academy of Restorative Dentistry, Atlantic City, N. J., July 10-11.

American Association of Dental Schools, Baltimore, Md., March 15-17.

American Dental Society of Europe, Paris, France, August 2-5.

American Society of Oral Surgeons and Exodontists, Atlantic City, N. J., July 9-10.

American Society of Orthodontists, Chicago, April 19-22.

Chicago Dental Society, February 15-18.

Dental Protective Association, Chicago, December 21.

Greater New York Meeting, December 7-11.

International Association for Dental Research, Baltimore, Md., March 13-14.

National Board of Dental Examiners, December 4-5.

North Atlantic Orthodontic Society, New York City, December 16.

American Society for the Advancement of General Anesthesia in Dentistry, New York City, fourth Monday in March and October.

Southern Society of Orthodontists, Atlanta, January 25-27.

Southwestern Society of Orthodontists, Shreveport, La., January 18-20.

Philadelphia County Dental Society, Philadelphia, February 3-5.

North St. Louis Dentists Meeting, January 27-28.

District of Columbia at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

American Association for the Advancement of Science, Subsection on Dentistry, Atlantic City, N. J., December 28.

STATE SOCIETIES

February

Minnesota at Minneapolis (23-25)

April

Alabama, at Mobile (12-14)
California, at San Jose (13-14)
Wisconsin, at Milwaukee (19-22)

May

Georgia, at Savannah (17-19)
Illinois, at Springfield (11-13)
Iowa, at Des Moines (4-6)
New York, at New York City (4-7)
North Carolina, at Pinehurst (3-5)
Pennsylvania, at Pittsburgh (4-6)
South Dakota, at Mitchell (10-11)
Tennessee, at Knoxville (10-13)
Virginia, at Virginia Beach (10-12)

June

Maine, at Rangeley (25-26)

STATE BOARDS OF DENTAL EXAMINERS

California, at San Francisco, December 7. Kenneth I. Nesbitt, 450 McAllister St., San Francisco, Secretary.

Iowa, at Iowa City, December 14-18; May 31-June 4. Hardy F. Pool, Mason City, Secretary.

Minnesota, at Minneapolis, December 11-17. Paul Hagen, Crookston, Secretary.

New Hampshire, at Manchester, December 17-19. Otis M. Littlefield, Manchester, Secretary.

New Jersey, at Trenton, December 7-12. State Board of Registration and Examination in Dentistry, 148 W. State St., Trenton.

North Dakota, at Fargo, January 11-16. W. E. Cole, Bismarck, Secretary.

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

Wisconsin, at Milwaukee, December 14-18. S. F. Donovan, Tomah, Secretary.

Texas, at Dallas, December 7-10. R. T. Weber, Austin, Secretary.

CALIFORNIA STATE DENTAL ASSOCIATION

The next annual meeting of the California State Dental Association will be held in the Civic Auditorium, San Jose, April 13-14.

F. T. West, *Secretary,*
2180 Washington St.,
San Francisco.

GEORGIA DENTAL ASSOCIATION

The sixty-ninth annual meeting of the Georgia Dental Association will be held at Savannah, May 17-19, at the Hotel DeSoto.

R. H. Murphy, *Secretary,*
920 Georgia Casualty Bldg.,
Macon.

IOWA STATE DENTAL SOCIETY

The seventy-fifth annual meeting of the Iowa State Dental Society will be held at the Fort Des Moines Hotel, Des Moines, May 4-6.

John Scholten, *Secretary,*
Cedar Rapids.

NORTH DAKOTA BOARD OF DENTAL EXAMINERS

The next examination of the North Dakota State Board of Dental Examiners for licensure will be held at the Gardner Hotel, Fargo, January 11-16. Applications and transcript of college grades must be in the hands of the secretary at least ten days prior to date of examination. For further information and application blanks, address

W. E. Cole, *Secretary,*
Bismarck.

AMERICAN SOCIETY OF ORAL SURGEONS AND EXODONTISTS

The nineteenth annual meeting of the American Society of Oral Surgeons and Exodontists will be held in Atlantic City, N. J., July 9-10.

Harry Bear, *Secretary,*
410 Professional Bldg.,
Richmond, Va.

AMERICAN ACADEMY OF RESTORATIVE DENTISTRY

The American Academy of Restorative Dentistry will meet July 10-11, at Atlantic City, N. J.

A. F. Schopper, *Secretary,*
Professional Bldg.,
Kansas City, Mo.

SOUTHWESTERN SOCIETY OF ORTHODONTISTS

The sixteenth annual meeting of the Southwestern Society of Orthodontists will be held at Shreveport, La., January 18-20. All members of the American Society of Orthodontists are invited to attend.

Harry H. Sorrels, *Secretary,*
Medical Arts Bldg.,
Oklahoma City, Okla.

CHICAGO DENTAL SOCIETY MIDWINTER CLINIC

The seventy-third annual Midwinter Clinic of the Chicago Dental Society will be held at the Stevens Hotel, February 15-18.

PHILADELPHIA COUNTY DENTAL SOCIETY

The Greater Philadelphia Annual Meeting (third annual meeting) of the Philadelphia County Dental Society (First District of the Pennsylvania State Dental Society) will be held at the Benjamin Franklin Hotel, Philadelphia, February 3-5.

Abram Cohen, *Chairman of Publicity.*

NORTH ST. LOUIS DENTISTS ANNUAL MEETING

The North St. Louis Dentists Eighth Annual Meeting will be held at the Chase Hotel, January 27-28.

A. C. Mogler,
4482 Washington Ave.,
St. Louis.

BRONX HOSPITAL INTERNSHIP

An examination for a dental internship for one year beginning with July 1 will be held December 29 at 8 p.m. in the Bronx Hospital, New York City. This is a modern hospital with a bed capacity of 310 for acute diseases. The hospital has an active

outpatient department in all branches of dentistry, including periodontia, oral surgery, root canal therapy and operative dentistry. Write for application form to the superintendent of the hospital, Fulton Ave. at 169th St., New York City.

ALPHA OMEGA FRATERNITY

The twenty-ninth annual international convention of the Alpha Omega Fraternity will take place at the Statler Hotel, Boston, Mass., December 29-31. For reservations, address Lewis J. Danovitch, 601 N. Washington St., Norwood, Mass.

By Order of Supreme Chancellor,
ALVIN H. BERMAN, *Supreme Scribe.*

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, SUBSECTION ON DENTISTRY

The Subsection on Dentistry of the American Association for the Advancement of Science will hold a morning and an afternoon session at Haddon Hall, Atlantic City, N. J., December 28. The program includes the following:

"Prefunctional and Functional Influences on Bone Growth, Based on Experiments with Transplanted Embryonic Mandibles," by Lawrence W. Baker, Harvard University, Boston, Mass.

"Aims and Purposes of the New York Institute of Clinical Oral Pathology," by Theodor Blum, D.D.S., M.D., New York City.

"Preliminary Study of the Gross, Bacteriologic and Roentgenologic Periapical Findings of Teeth Obtained from Human Necropsies," by L. W. Burket, D.D.S., M.D., School of Medicine, Yale University, New Haven, Conn.

"Squamous Cell Carcinoma of the Tongue as a Sequel to Leukoplakia," by Malcolm W. Carr, D.D.S., New York City.

"Diagnostic Importance of the Tongue in Internal Medicine," by B. I. Comroe, M.D., Schools of Medicine and Dentistry, University of Pennsylvania, Philadelphia.

"Experimental Production of Periapical Tooth Infection in Monkeys and Its Relation to Systemic Disease," by Harold Genvert, D.D.S., M.D., Henry Miller, D.D.S., M.D., and Casper Burn, M.D., Yale Medical School, New Haven, Conn.

"Biological Aspects of the Dental Pulp," by Raymond Gettinger, M.D., New York Institute of Clinical Oral Pathology, New York City.

"Comparison of Diurnal and Nocturnal p_H Values of Saliva," by L. I. Grossman, D.D.S., Dr. med. Dent., and B. M. Brickman, D.D.S., New York City.

"Present Status of Electrical Pulp Testing," by Theodore Kaletsky, D.D.S., New York Institute of Clinical Oral Pathology, New York City.

"Histological Studies on Dental Granulomata," by M. W. McCrea, D.D.S., School of Medicine and Dentistry, University of Rochester, Rochester, N. Y.

"Histological Studies of Dental Ameloblastomata," by Hamilton Robinson, D.D.S., M.S., School of Medicine and Dentistry, University of Rochester, Rochester, N. Y.

"Effects of Temperature on Setting, Flow and Expansion of Amalgams," by E. W. Skinner, Ph.D., Northwestern University Dental School, Chicago, Ill.

"Relationship Between Time and Temperature of Vulcanization," by P. B. Taylor, A.B., A.M., Western Reserve University Dental School, Cleveland, Ohio.

"Influence of the Supersensitive State on the Dissemination and Localization of Streptococcus Viridans in Rabbits' Teeth," by David Weisberger, D.D.S., M.D., Yale University Medical School, New Haven, Conn.

"Effect of Hormonal Treatment on the Gums and Oral Mucosa of Women: A. With the Use of Estrone. B. With the Use of Gonadotropic Hormone Folluetin," by D. E. Ziskin, D.D.S., School of Dental and Oral Surgery, Columbia University, New York City.

Address inquiries to

J. L. T. APPLETON,
4001 Spruce St.,
Philadelphia, Pa.

NEW BOOKS MAKE EXCELLENT GIFTS

SUGGESTIONS FROM THE LIBRARY BUREAU of the AMERICAN DENTAL ASSOCIATION 212 E. Superior St., Chicago, Ill.

Blair, V. P., & Ivy, R. H.	Essentials of oral surgery. St. Louis, Mosby, 1936. $6.50.
Blayney, J. R.	Dental pharmacology and therapeutics. St. Louis, Mosby, 1936. $4.00.
Broderick, F. W.	Principles of dental medicine: the medical aspects of dental disease. St. Louis, Mosby, 1936. $7.50.
Bunting, R. W.	Oral hygiene and the treatment of parodontal diseases. Philadelphia, Lea & Febiger, 1936. $2.50.
Dilling, W. J., & Hallam, Samuel	Dental materia medica, pharmacology and therapeutics. London, Cassell & Co., 1936. $3.25.
Dunning, W. B., & Davenport, S. E.	Dictionary of dental science and art. Philadelphia, Blakiston, 1936. $6.50.
Ennis, L. M.	Dental roentgenology. Philadelphia, Lea & Febiger, 1936. $6.50.
Greenfield, A. L.	X-ray technic and interpretation of dental roentgenograms. Brooklyn, N. Y., Dental Items of Interest, 1936. $6.00.
Haden, R. L.	Dental infection and systemic disease. Philadelphia, Lea & Febiger, 1936. $2.50.
McClendon, J. F., & Pettibone, C. J. V.	Physiological chemistry. St. Louis, Mosby, 1936. $3.50.
McGehee, W. H. O.	Text-book of dental pharmacology, materia dentica and pharmacotherapeutics. Philadelphia, Blakiston, 1936. $4.25.
McGehee, W. H. O.	Textbook of operative dentistry. Philadelphia, Blakiston, 1936. $10.00.
Miller, S. C.	Oral diagnosis and treatment planning. Philadelphia, Blakiston, 1936. $7.50.
Pearlman, L. M.	Your breath and your health. New York, Academy Pub. Co., 1936. $1.00.
Prinz, Hermann	Dental formulary. Philadelphia, Lea & Febiger, 1936. $3.50.
Rhinehart, D. A.	Roentgenographic technique. Philadelphia, Lea & Febiger, 1936. $6.50.
Schwartz, J. R.	Cavity preparation and abutment construction. Brooklyn, N. Y., Dental Items of Interest, 1936. $6.50.
Shelling, D. H.	Parathyroids in health and in disease. St. Louis, Mosby, 1936. $5.00.
Skinner, E. W.	Science of dental materials. Philadelphia, Saunders, 1936. $4.50.
Thoma, K. H.	Oral diagnosis and treatment planning. Philadelphia, Saunders, 1936. $6.00.
Thompson, W. S.	Operative and interpretive radiodontia. Philadelphia, Lea & Febiger, 1936. $7.00.
Wald, S. S.	Manual of dental roentgenology. New York, Guggenheim Dental Clinic, 1936. $2.25.
Widdowson, T. W.	Dental surgery and pathology. London, John Bale, 1936. $9.00.

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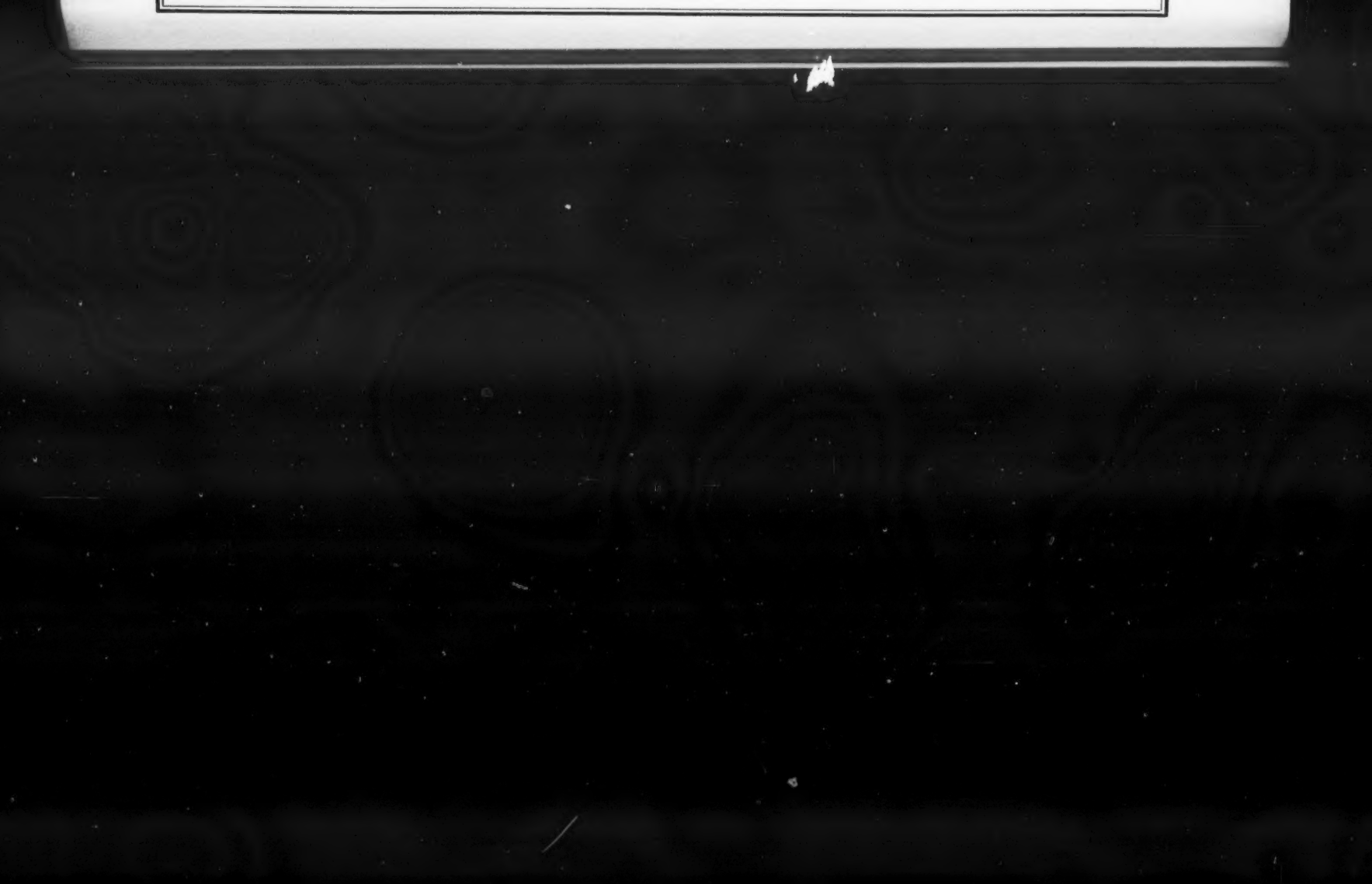

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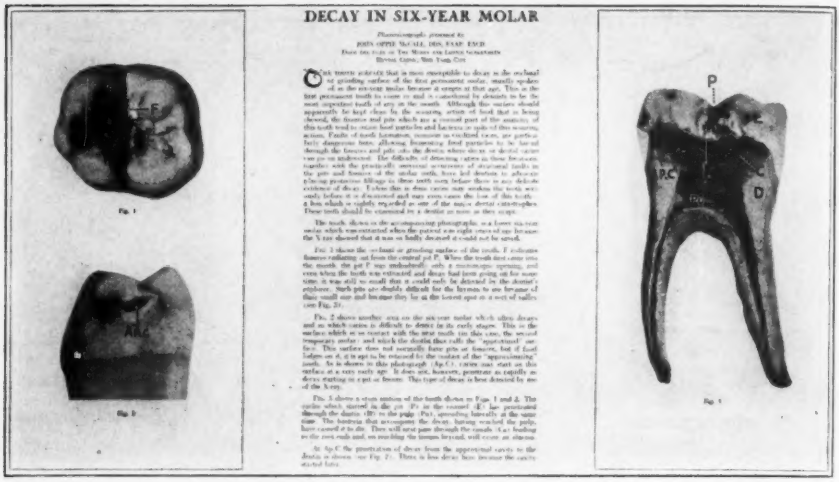

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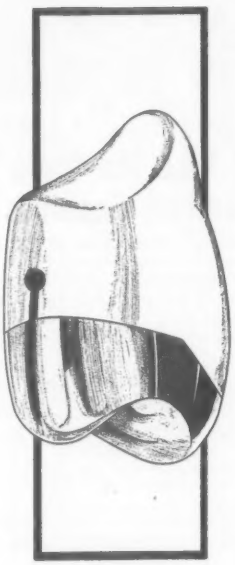

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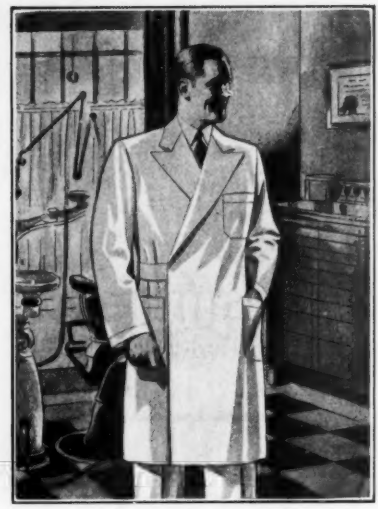

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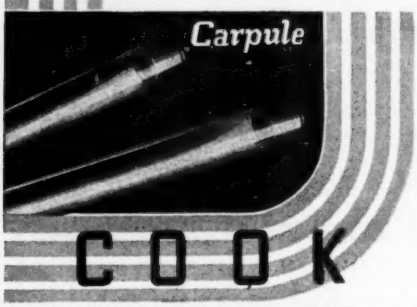

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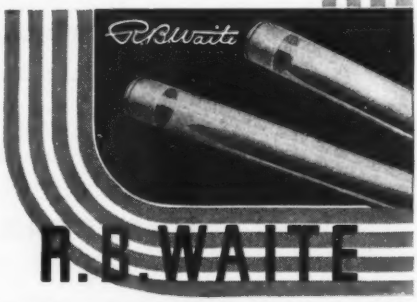

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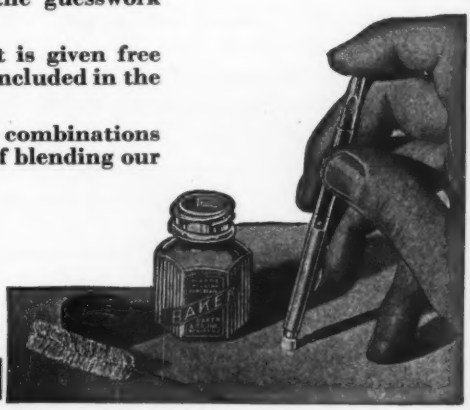

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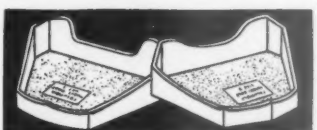
Progress may, perhaps, be perceived by historians; it can never be felt by those actually involved in the supposed advance. The young are born into the advancing circumstances, the old take them for granted within a few months or years.—Aldous Huxley.

* * *

The only efficacious remedy against capitalism is not socialism but Christianity, provided it is capable of absorbing the truth and rejecting the errors of socialism.—René Gillouin.



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DENTURES

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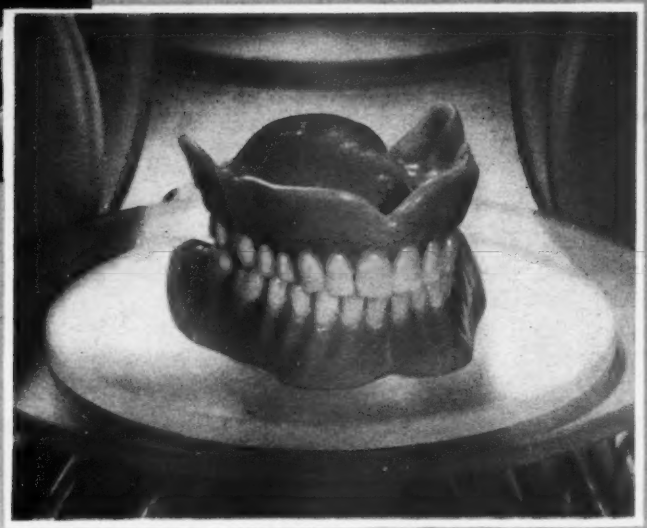

GRATIFYING TO BOTH DENTIST AND PATIENT

When a dentist sees his finished Luxene resinoid denture he feels well repaid for the time, labor and skill that he put into making the impression and pattern. He cannot fail to be gratified by its quality appearance, and the accuracy with which his pattern is reproduced. Likewise, the patient will be gratified by the comfort of a Luxene resinoid denture and its close resemblance to the translucent color of healthy gums.

But these are by no means all of the advantages of Luxene resinoid. It also is dense, hard and lustrous. Oral secretions and food juices cannot penetrate the surface, so there is neither absorption nor staining. Surface deposits are easily removed and sanitary cleanliness assured. As Luxene resinoid is chemically inert, the acids and alkalies in foods, drinks and medicines have no effect upon it. It also is strong, yet light in weight.

In Luxene resinoid the dental profession is provided with a denture material possessing a combination of properties which have long been desired. Thousands of dentists who are using it are most enthusiastic in their endorsements.

May we not suggest that you prescribe Luxene resinoid for the next denture that you require, and discover for yourself its many advantages. Also write us for a copy of the 32-page booklet, "The Story of LUXENE Resinoid."

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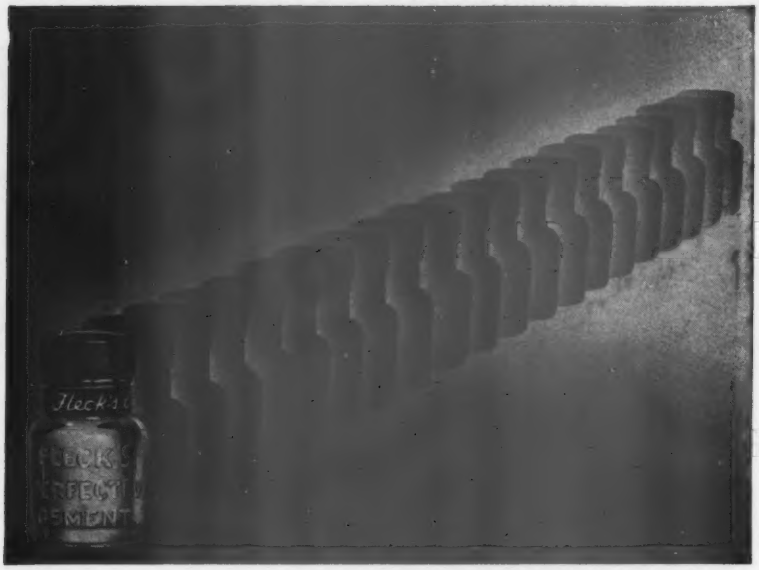

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Constant control tests guarantee uniformity of chemical and physical properties of Fleck's Cement in all colors, in accord with A.D.A. Specification No. 8. Our laboratory tests record 11,000 lbs. per sq. in. within half hour after mix, securing cementation when patient is dismissed.

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TOOTH PASTE

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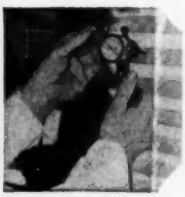
Beginning with chemical and physical analyses of each batch of steel, the production of New Cutwell burs is checked by rigid tests and inspections at every stage of manufacture. Typical of the many check-ups which New Cutwells must undergo to insure their uniformly satisfactory performance in your hands, are the following:



In process of production New Cutwells are regularly checked for neck size with micrometer gauges—

. . . and for head size with "go and no-go" gauges. Size is held within .01 mm.—or .0004 inch.

Every New Cutwell bur must pass this final test for trueness of head, neck and shank—

. . . and this extra searching inspection under the magnifying glass for blade perfection.

● ***This uncompromising inspection system is one of the factors that make New Cutwell burs more costly to produce, but more economical to use. In fact, at present low prices New Cutwells cost so little more than ordinary burs that they are the most economical burs you can buy.***

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VITAMIN UNITS AND STANDARDS

● The past five years have brought agreement between biochemists of the various nations as to suitable units and standards of reference for most of the vitamins essential to man. The practice of expressing the vitamin potencies of foods and other biological materials in terms of *International Units* is, therefore, fast becoming universal.

Believing that these units and the standards upon which they are based would be of interest to our readers, they have been tabulated and defined below (1):

Vitamin A

The reference standard is a solution of pure beta-carotene in an inert oil, of such concentration that one gram of solution contains 300 micrograms (0.300 mg.) of beta-carotene. The International Unit, or I.U., of vitamin A is the vitamin A activity of 2 mg. of this standard solution, or 0.6 micrograms of beta-carotene.

Vitamin B1

The reference standard is the concentrate produced from rice polishings, by a specified adsorption method, in the Medical Laboratory of Batavia (Java). The International Unit for vitamin B_1 is the vitamin B_1 activity of 10 mg. of this standard adsorption product.

Vitamin C

The standard of reference for vitamin C is a specified sample of pure levo-cevitamic acid (levo-ascorbic acid). The International Unit for vitamin C is the vitamin C activity of 0.05 mg. of this standard.

Vitamin D

The reference standard for vitamin D is a solution of irradiated ergosterol, prepared under specified conditions at the National Institute for Medical Research (London). The International Unit for vitamin D is the vitamin D activity of 1.0 mg. of this standard solution.

These International Units for expressing vitamin contents have been specified in the most recent Pharmacopoeia of the United States (2) as well as by the Council on Pharmacy and Chemistry (3) and the Council on Foods of the American Medical Association (3), and provision has been made for distribution of the standards in this country (4).

These units have been used to express vitamin potencies in recent studies on canned foods, the results of which further emphasize the fact that these foods rank among the most important sources of the vitamins essential in human nutrition (5), (6), (7).

AMERICAN CAN COMPANY

230 Park Avenue, New York City

(1) 1935. Nutrition Abstracts and Reviews 4, 709.
(2) The Pharmacopoeia of the United States of America, Eleventh Decennial Revision, p. 261.
(3) 1936. Report of the Council, J. Amer. Med. Assoc. 106, 1733.
(4) 1935. J. Assoc. Official Agr. Chem. 18, 610.
(5) 1935. J. Home Econ. 27, 658
(6) 1936. Food Research 1, 223.
(7) 1935. J. Nutrition 9, 667.

This is the nineteenth in a series of monthly articles, which will summarize, for your convenience, the conclusions about canned foods which authorities in nutritional research have reached. We want to make this series valuable to you, and so we ask your help. Will you tell us on a post card addressed to the American Can Company, New York, N. Y., what phases of canned foods knowledge are of greatest interest to you? Your suggestions will determine the subject matter of future articles.

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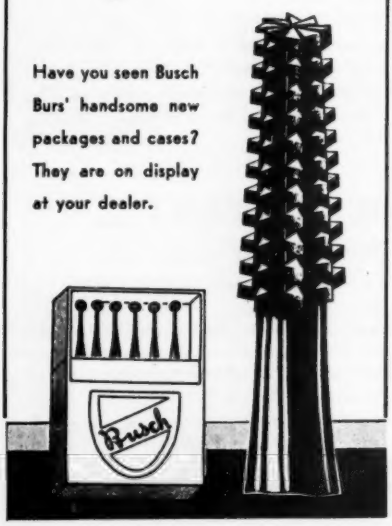

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NOTES AND QUOTES

The ability to know is what raises people above the commonplace. With some people this faculty seems to be an instinctive one. Knowing the reason for things that are happening may be called, for the want of a better word, understanding. People endowed with this gift are usually kind in their attitude and simple in their manner.—Helen Wills Moody.

* * *

Talent is built in solitude; character in the stream of the world.—Goethe.

* * *

As far as mental ability is concerned, there need be no "retiring age." The probabilities are that the older a person becomes, the more valuable he becomes. He possesses the same mental power he had in his young manhood plus his wealth of experience and knowledge of his particular job.—Irving Lorge.

* * *

The ability to use experience—even of others—to attain one's ends, is true intelligence.—Will Durant.

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NO WABBLY denture inhibits her oral functions, causing physical discomfort and the usual mental distress. No irritations make her tissues unbearably sore. Her denture, though new, is stable and comfortable — she is rapidly learning to use it with ease — thanks to her dentist, who thoughtfully prescribed DR. WERNET'S Powder.

It forms an elastic, adhesive, and protective cushion between the denture and the tissues. It holds the denture, *mechanically,* more firmly in place, and soothes and protects tissues that are tender. By promoting comfort and greater assurance, it makes it possible for the denture to be worn more regularly, thus hastening its mastery by the patient.

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Speeds the Mastery of a New Denture!

Statement Showing the Increase in the Activities

of the

American Dental Association

Expense Items in 1926	*Expense Items in 1936*
Secretary-Business Manager	Secretary-Business Manager
Journal	Journal
Annual Sessions	Annual Sessions
Treasurer	Treasurer
Board of Trustees	Board of Trustees
Bureau of Dental Health Education	Bureau of Dental Health Education
Committee on Dental Legislation	Committee on Dental Legislation
Research Commission	Research Commission
Educational Council	Educational Council
Dental Index Committee	Dental Index Committee
Relief Commission	Relief Commission
Relief Fund Committee	Committee on Dental Education
7th International Congress	Judicial Council
	Council on Dental Therapeutics
	Bureau of Chemistry
	Library Bureau
	Committee on Membership
	President's Expense
	Honorarium to President
	Budget & Finance Committee
	Investment Committee
	Nat'l Board of Dental Examiners
	Committee on Economics
	Committee on Dental Health Education
	National Museum Committee
	Efficiency Survey

Total General Fund Expense Items in 1936 26
Total General Fund Expense Items in 1926 13

Increase in Expense Items (100%) 13
(No increase in membership dues)

American Dental Association dues $4.00
Journal subscription portion 2.50

Balance to be pro-rated for 25 expense items (excluding The Journal) $1.50
Average amount available for each expense item ..... .06

In 1936 each MEMBER paid an average of 6c for each of the 25 activities listed above.

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Extract from paper read by Dr. Kells before the National Dental Association, New Orleans, October, 1919

C. Edmund Kells, D. D. S.
1856 - 1927

A pioneer in dental radiology who contributed immeasurably to its advancement. In 1896, Dr Kells gave the first dental x-ray clinic ever held, before the Southern Dental Association at Asheville, N. C. Author of "Three Score Years and Nine."

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45,000 Members in 1937

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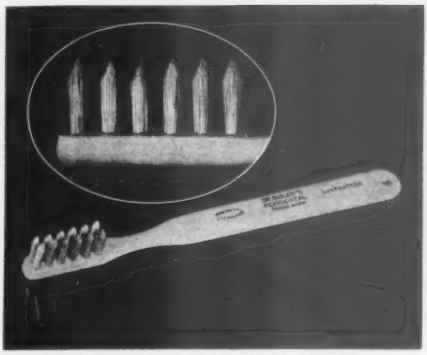

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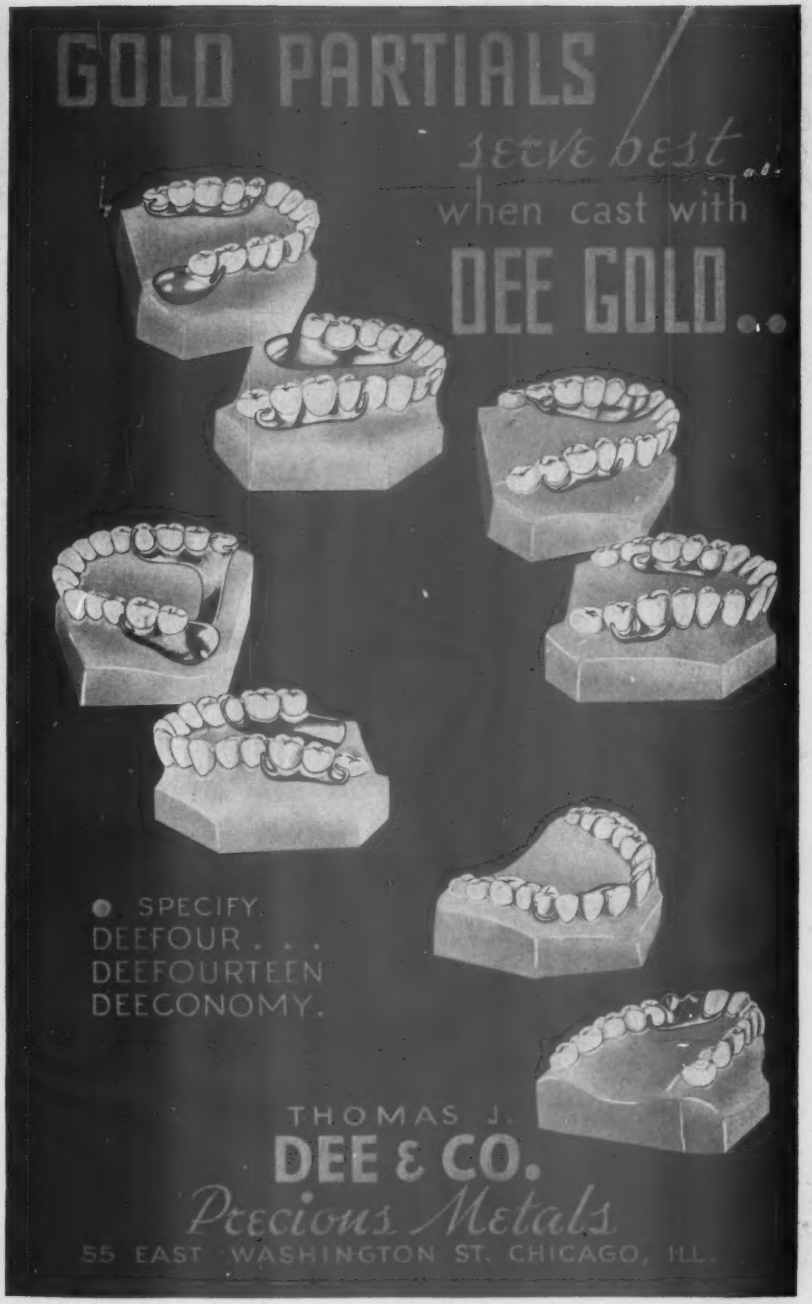
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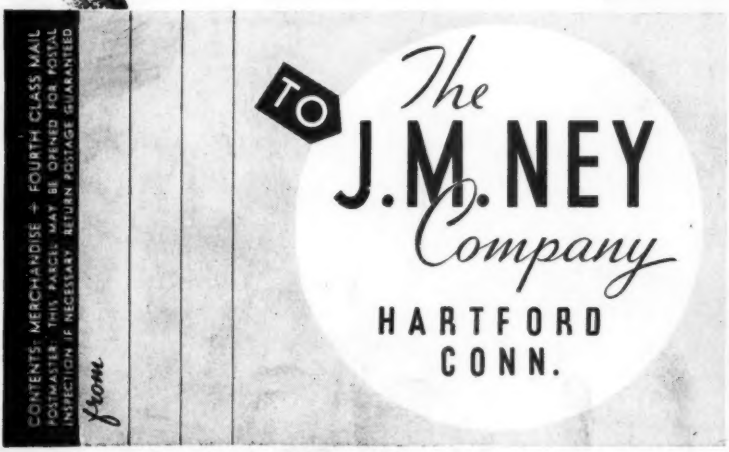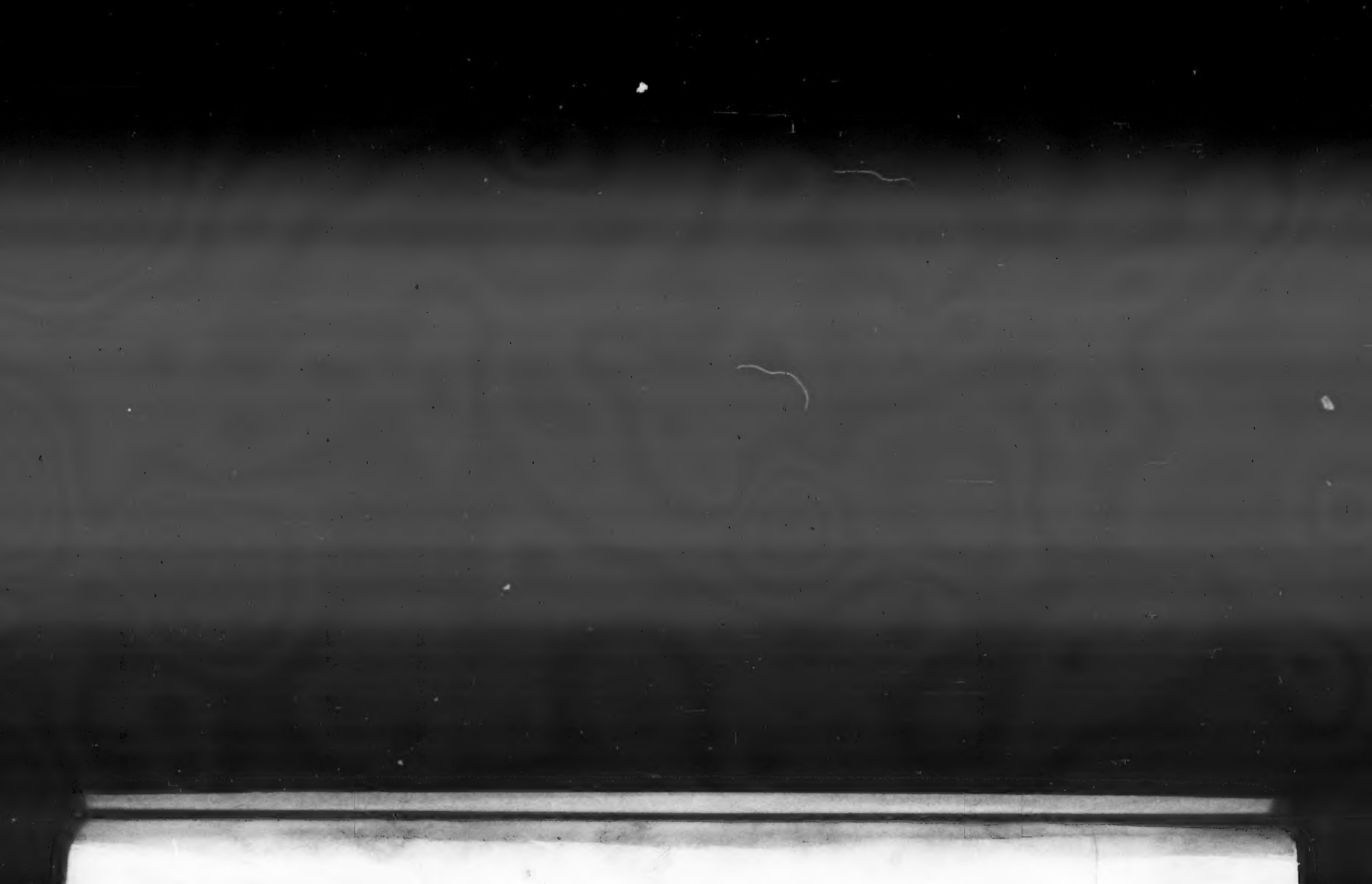
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